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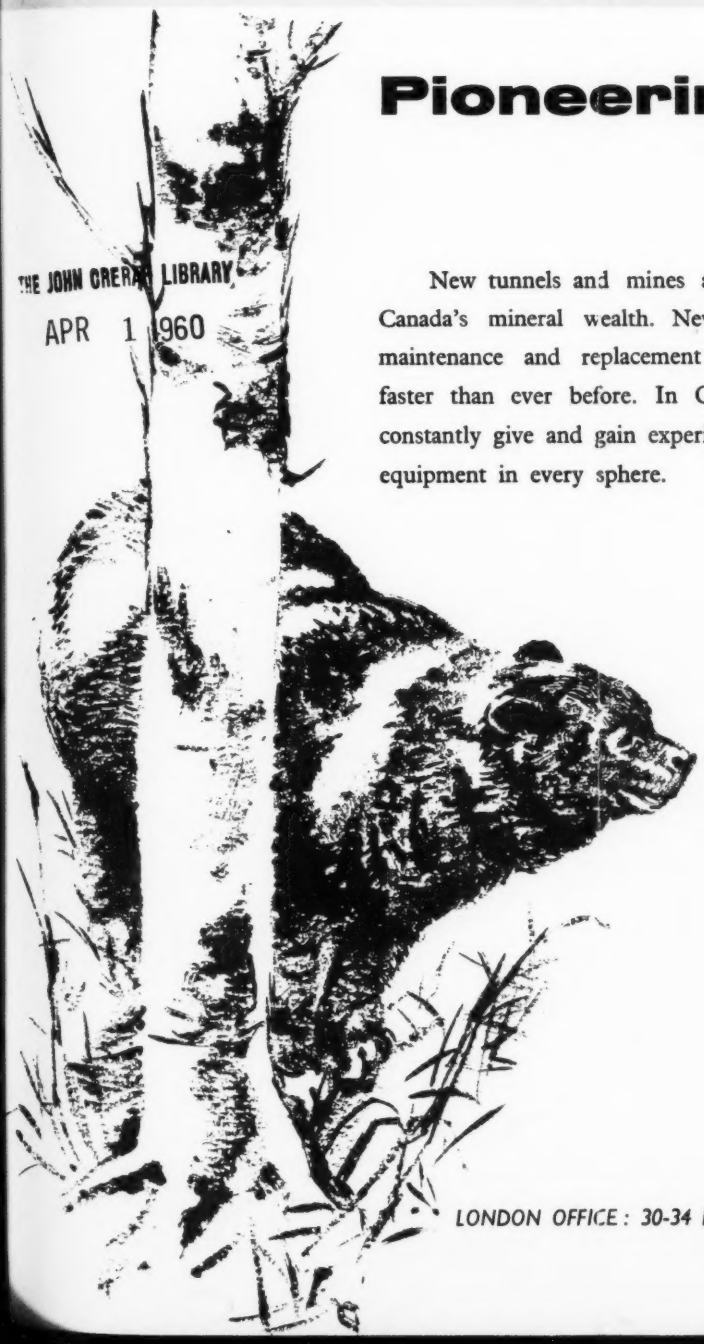

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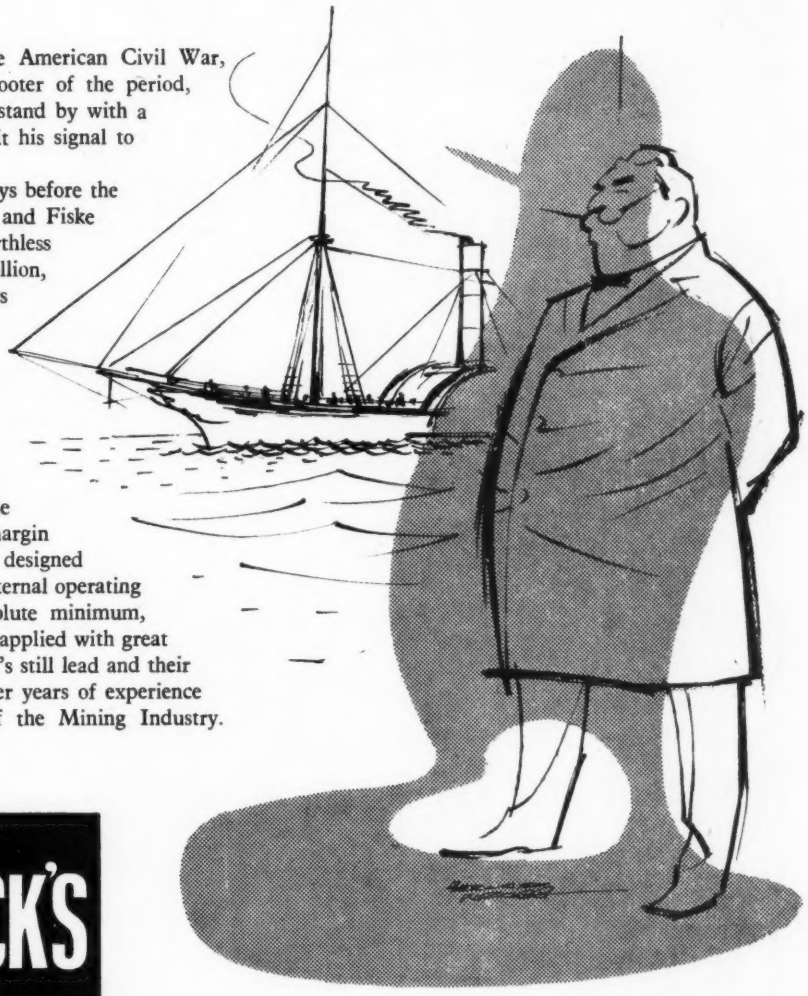

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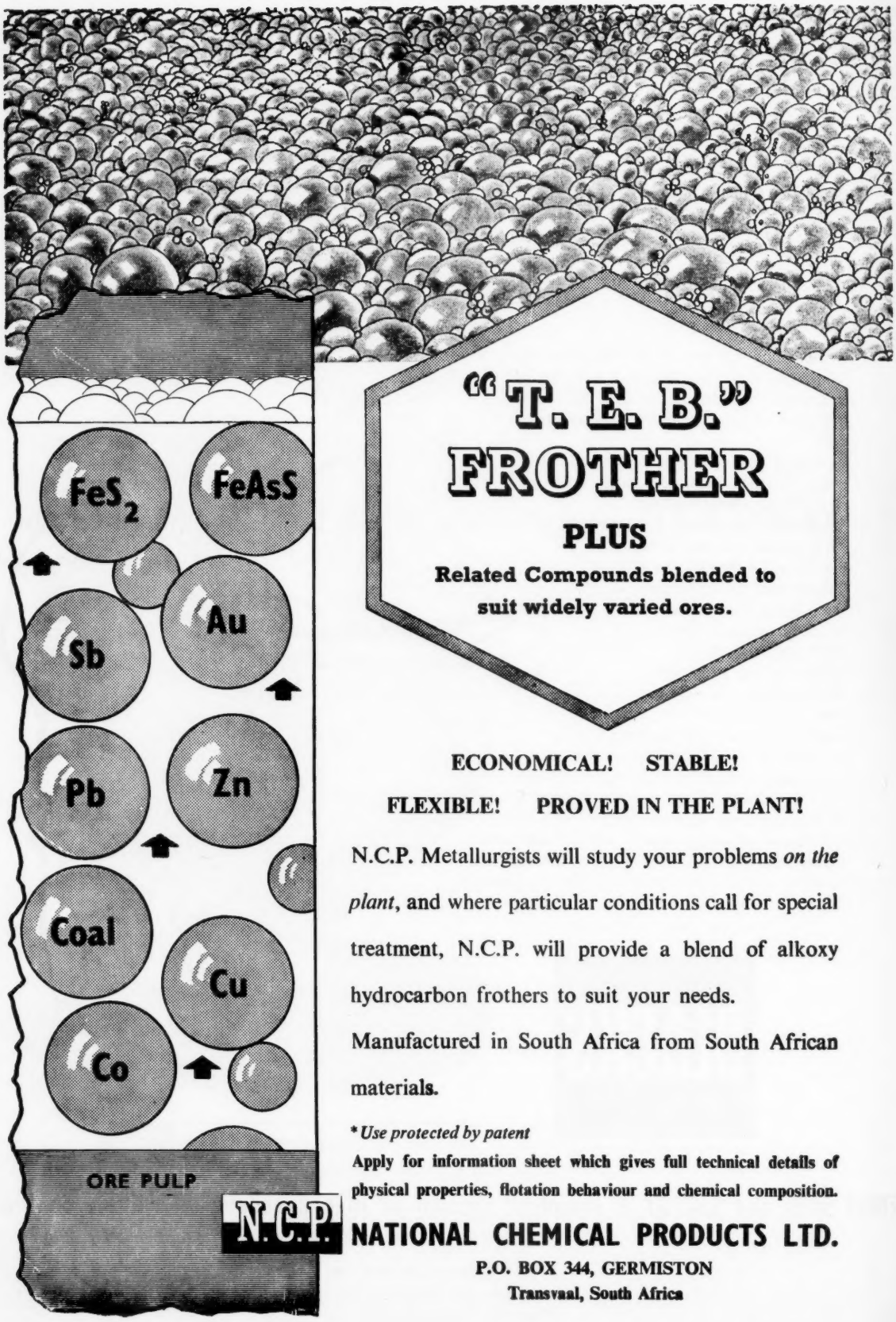

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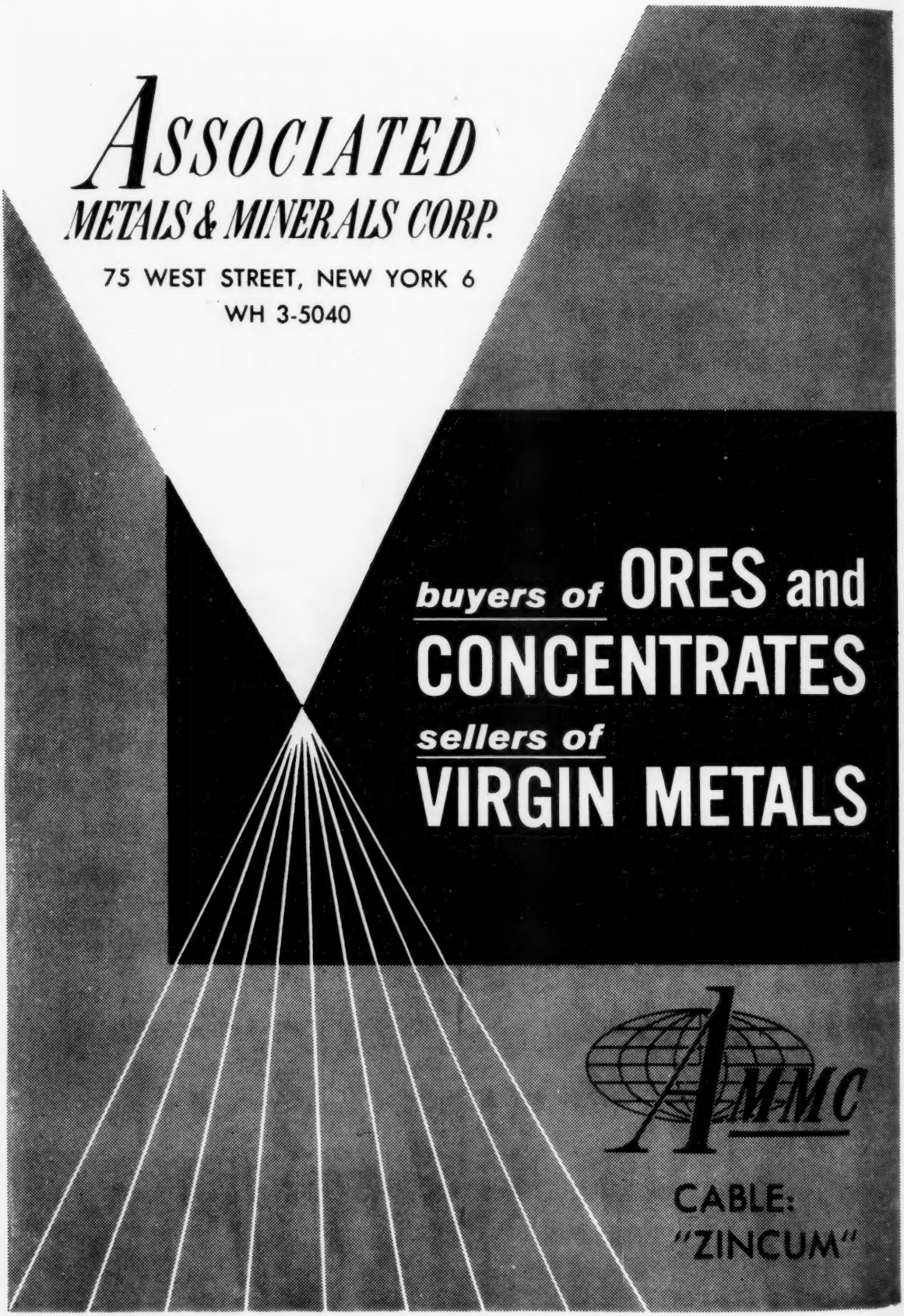
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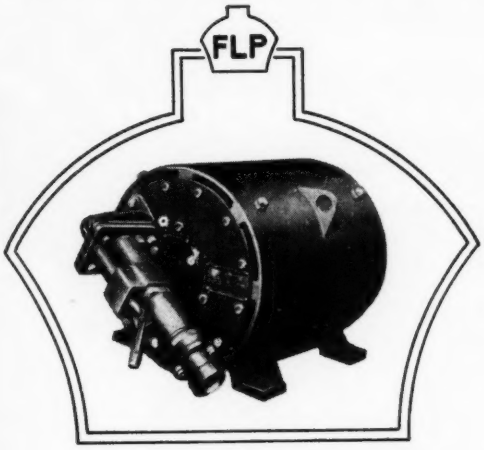

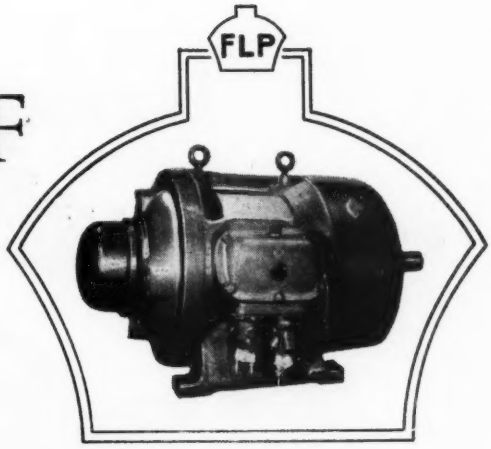

Top Left: *Totally-enclosed fan-cooled flameproof squirrel-cage motor, type KF.*
Top Right: *T.E.F.C. flameproof slipring motor, type FW.*

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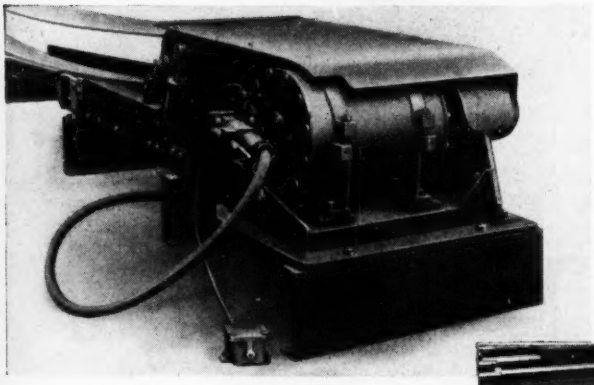

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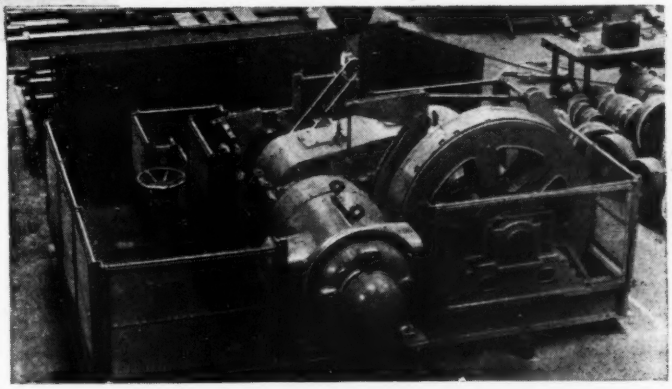
Above: *Type KF flameproof motor driving a "Huwood" conveyor.*
Right: *125 hp, 580 rpm totally-enclosed, fan-cooled, flameproof slipring induction motor driving Beckett and Anderson "Man-Riding" haulage for a colliery. Electro-hydraulic thrustor operating main brake is seen on left of motor.*



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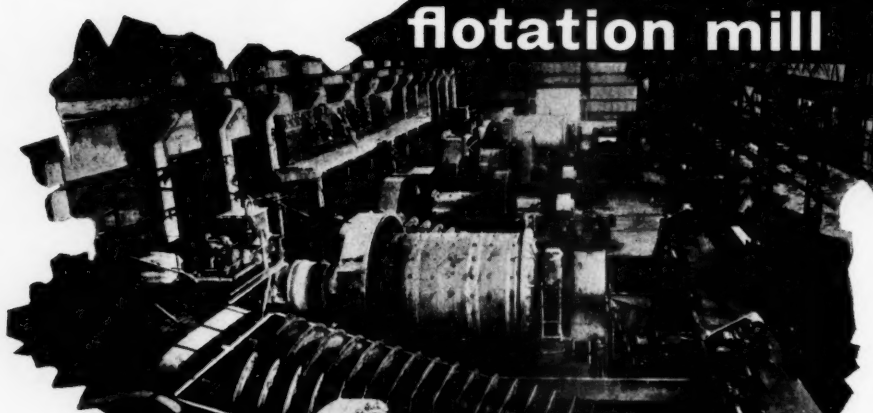

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The Mining Journal

London, March 11, 1960

In this issue . . .

The Challenge to U.S. Minerals Supremacy	291
Japanese Interest in Australian Minerals	292
Exploration for Minerals in Ghana ...	292
High Authority Acts	293
Opal Mining in Australia	293
Mining in the Rhodesias in 1959	293
Tanganyika's Record Mining Year ...	294
Laboratory Investigations in the Nickel Smeltery	296
Chromite and Natural Gas	298
Technical Briefs	299
Mining Miscellany	300
Metals and Minerals	302
London Metal and Ore Prices	302
Mining Finance	304
Company Meetings	306
Book Reviews	307

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The Challenge to U.S. Minerals Supremacy

NOT the least noteworthy aspect of the recent convention of the American Institute of Mining, Metallurgical and Petroleum Engineers in New York was the attention accorded to the rapid progress of mineral and metallurgical development in both Russia and Communist China, which, it was contended, underlined the necessity for a more effective national minerals policy in the United States.

Dr. Arthur B. Cummins, newly installed president of the Mining Engineers Society of the Institute, expressed the opinion that there was no apparent way to stop Russia from catching up with the United States in the production of mineral raw materials and finished metal products. He estimated that the Soviet Union was employing about 40,000 geologists, whereas in the United States enrolment in geology and related sciences was declining. There was a need for more adequately trained engineers for minerals research, exploration, management operations, and the specialized technical fields.

According to Dr. Cummins, Russia is producing about 16 per cent of the world's mineral products, in value, and the Sino-Soviet *bloc* of nations is practically self-sufficient in minerals. Moreover, the rising percentage in Russian production of most minerals in relation to United States output is gaining importance. Though still far behind the United States in total mineral-metal output, the Soviet Union is out-producing the United States in coal by about 125,000,000 tons a year.

Reference was also made to the production and exportation by Russia of mining equipment and processing machinery. It was stated that Russian mining equipment could be sold in the near future in the United States and also in foreign markets which were important to U.S. equipment manufacturers. Dr. Cummins considered it doubtful, whether at the present time exported Russian equipment could compete with U.S. equipment on a quality and performance basis. "But what about comparative prices," he asked, "and what may we expect in future?"

Communist China's mining progress was surveyed by K. P. Wang, Far East Specialist, Division of Foreign Affairs, Bureau of Mines, who pointed out that the mineral industries loomed large in the industrial framework as well as the over-all economy of the country. They already contributed significantly to the gross national product, the 1958 value of mineral output having been about 4.5 per cent of the GNP. The Communist regime fully recognized that the key to China's industrial progress lay in the uncovering and efficient utilization of its mineral wealth.

Mr. Wang emphasized that it was fallacious to assume that the Chinese Communists were not cost conscious and did not believe in efficient practices. Furthermore, great strides had been made in training technicians and industrial workers to supply the manpower needed in mineral development.

China's most outstanding developments, it was stated, were probably in the production of coal and iron and steel. Chinese coal output, which is steadily rising, now ranks third in the world and constitutes more than one-tenth of the world total. Chinese iron and steel output also has attained noteworthy levels. The view was expressed that Communist China, now the seventh largest world producer, might reach fifth position by 1965. Many other mineral industries were undergoing rapid expansion, and most would become medium size by world standards within five years.

Mr. Elmer W. Pehrson, director of foreign activities of the Bureau of Mines and lecturer at Columbia University, declared that the United States had been drifting with complacency, especially in view of the technical and mineral utilization advances of the U.S.S.R. While the United States still had more than twice the Soviet steel productive capacity, he stated, Russian steel capacity grew from 5,000,000 tons in 1930 to over 60,000,000 tons in 1958. In other words, the Soviets accomplished in 28 years what it took America nearly 50 years — from 1880 to 1929 — to achieve.

On the other side of the balance sheet, Mr. Alexander Gakner, East European specialist of the Bureau of Mines, expressed the opinion that, despite notable research achievements in mining methods and smelting techniques, Russia could not compete in world markets unless " Ivan and his colleagues " continued to work at wages which were substantially lower than elsewhere. Experts at the Bureau of Mines, he stated, believed that, under equal circumstances, free, competitive societies were much more conducive to efficient operation of industry. Productivity of the U.S.S.R. was quite low, an average of about 2½ as many people being required to do a particular job as compared with the United States. The relative inefficiency of the Soviet mineral industry, however, was not all due to Communist bureaucratic inefficiency, other reasons being the use of low-grade resources ; mining in areas which were accessible only with great difficulty ; the use of obsolete equipment ; and inadequate transportation.

The strength of the Soviet Union, as Mr. Gakner sees it, lies in the apparent determination to overcome these problems and maintain a unity of purpose. Whatever the political considerations, he stated, the Russians have already demonstrated their ability to attain a high level of technology, which, in some applications, is comparable to and sometimes even exceeds, that of the United States.

The seriousness with which Communist achievements, not only in such spectacular fields as space technology but also in the development of mineral resources, have come to be regarded in the United States, was indicated by the attention accorded at the convention to national minerals policy. Stress was laid on the need for an effective, purposeful policy that would resolve or alleviate many of the conflicting and controversial views relating to stockpiling, imports, conservation, tariffs, and associated matters. Mr. Pehrson, in particular, was highly critical of those who would release valuable strategic metals from the stockpile to help in balancing the budget. He also criticized those who were " obsessed " with the idea that technology and science would solve metal supply problems in the future, or who claimed that new hidden deposits of minerals would be discovered in the United States.

The development and exploitation of mineral resources are basic to all industrial progress and these fields are of more crucial importance to Western Democracy than the conquest of outer space. If American reaction to the Communist challenge takes the form of a more realistic and less sectional approach to certain controversial aspects of national minerals policy, this in itself would be a development of great potential significance to other Free World countries. At the same time it is pertinent to reflect that if, as urged at the convention, new thinking on American mineral policy is urgently needed, there is still less justification for continued official complacency in Britain and other Free World countries, where the approach to minerals procurement still seems to be based on a dangerously short-sighted approach to problems of future supply.

JAPANESE INTEREST IN AUSTRALIAN MINERALS

Peko Mines has entered into a long term contract with Japanese smelters for the purchase of 30,000 tons of copper concentrates per year, which tonnage is the yearly capacity of the plant, but last year's output was only 24,126 tons. Terms of purchase are not known, but any modification in transport and refining charges will be very beneficial, for under existing conditions, these charges in 1958-1959, amounted to £A953,000, or about one-half the total value of the metal sales.

Continuation of the Copper Bounty is important to the future of Peko Mines. Its reserves of copper-gold ore in the parent mine are 1,000,000 tons, insufficient to warrant the cost of a smelter. Driving at Peko Mines' Orlando prospect is opening up ore assaying from 6 to 10 dwt. gold and 6 to 7 per cent copper ; a drill hole intersecting the lode at a vertical depth of 570 ft. located values of 11 dwt. gold, over a width of 25 ft. The shaft is to be deepened to 580 ft.

Japan is showing increasing interest in Australian minerals. The contract with Peko Mines for the purchase of copper concentrates has been followed by negotiations with Mount Morgan Ltd. for the purchase of copper concentrates to the value of £A2,000,000. The company has also had enquiries from Japan for coal from the Dawson Valley colliery, which supplies the Mount Morgan mine. Shipments of coal have been made from Newcastle, and important discussions are in progress for coking coal from the Kianga deposit in central Queensland. Large scale transport to the coast for shipment overseas is a problem which, it is stated, the State Government is unwilling to provide, but report states that the Japanese interests concerned are agreeable to construct a railway, 116 miles long, at a cost of £A7,000,000. Anticipated traffic is about 3,000,000 tons of coal per year.

The Sumitomo Metal and Mining Company, a leading Japanese copper smelter, is sending a survey group, consisting of a geologist and a prospecting expert, for a one-month survey of the possibility of developing copper mines in eastern and southern Australia. The team left by air for Australia on March 4.

EXPLORATION FOR MINERALS IN GHANA

The aerial geophysical survey announced by the Ghana Government as part of their Second Development Plan will play a major part in the investigations of the mineral resources of the country. The two areas concerned include most of the gold and manganese mines in Ghana and are known to be important mineralized zones.

The project has been planned by the Ghana Government and the United States International Co-operation Administration, the cost being shared between them. International tenders were invited from companies with the necessary technical qualifications and equipment for the task, and, after careful consideration of all the tenders submitted, the contract was awarded to the geophysical division of Hunting Surveys Limited, London.

The survey will cover an area of 4,800 square miles from the coast near Takoradi to Kumasi, and a second area of 1,800 square miles from Accra across the Volta river to the border of Dahomey. The first requirement will be to obtain photography of the areas at 1/30,000 scale, for which the

aeroplane will fly at 15,000 ft. Photo-mosaics will then be prepared for use as navigational aids for the subsequent geophysical flying. For this photography an aeroplane equipped with a high precision camera will be moved to Ghana in March.

When the photographic flying is complete the camera will be replaced by a magnetometer and a radiation counter, the former to give indication of the composition and geometry of the base rocks in the area, by recording variations in the total magnetic field, and the latter to measure and record variations in the radioactivity on the earth's surface. For the geophysical operation the aeroplane will fly at 600 ft. above the ground, on parallel tracks 580 yd. apart, to form a grid of survey flight lines over the thickly forested country. It is to assist the navigator to fly these low level sorties correctly that the mosaics made from the photographic coverage will be used.

From the records obtained by the geophysical instruments, preliminary data will be extracted in Ghana and subsequently isomagnetic and radioactivity maps will be produced at the laboratories of Hunting Surveys Limited in England.

The survey from the air will give a broad assessment of the mineral possibilities of the areas covered in far less time than such information could be gathered by any other means, and from an analysis of the results the most promising areas for more detailed ground investigation in the future will be chosen.

By the use of such modern techniques for the investigation of the resources of their country the government of Ghana has shown that the Second Development Plan is to be pressed forward vigorously.

HIGH AUTHORITY ACTS

The High Authority, supranational governing body of the European Coal and Steel Community, has recently vetoed a request by the West German coal owners to set up a single selling organization. The High Authority has stated that the creation of such an organization would contravene Article 65 of the Treaty which embraces West Germany, France, Italy and the Benelux countries. This Article only permits selling agreements by coal or steel companies if it is considered that such agreements markedly improve production or distribution, and do not give the interested companies the power to set price levels or control production. Integration of the existing sales organizations could conceivably lead to infringement of Clause 65 in that the setting of arbitrary price levels would be facilitated.

The entire question is to be fully discussed at a subsequent meeting of the High Authority and representatives of the Federal German Government and the coal industry.

OPAL MINING IN AUSTRALIA

Because of the growing popularity of the Australian opal in Japan, that country has now become by far the leading buyer of the stone. The U.S.A. has remained a consistent buyer since World War II, as a result of the fascination of the Australian gemstone for American soldiers who visited the Pacific.

Japan, which formerly had shown little interest in Australian opal, entered the market in a substantial way four years ago, and since then the value of exports to that country has increased to a surprising extent. This interesting trade development affecting a comparatively small mineral industry is revealed in the leading article on " Australian Gemstones " in the latest issue of the Quarterly Review of the Australian Mineral Industry. The article shows that Japan's purchases of Australian opal increased in value from £5.780 in 1955 to £164,969 in 1958. The U.S.A., now relegated to second highest buyer, bought opal worth £74,393 in 1958. The total value of all exports of opal from Australia in 1958 was £351,342, which was the highest figure ever recorded.

Japan's appearance in the market has had considerable impact on the industry in that substantial sales of other than first quality stone have been possible.

The keen overseas demand in recent years has heightened interest in the industry. The numbers working on the Andamooka and Coober Pedy fields in South Australia, where the largest operations are now taking place, have increased. Modern earthmoving and other equipment are now being applied successfully to opal mining in Australia. The wider application of these techniques may well lead to new fields being established and a significant increase in production.

Most of the important gemstones occur in Australia, but in terms of total value the mineral production of them has been extremely small. In spite of the revival in opal mining, particularly since World War II, the total recorded value since the end of last century has been only £3,200,000.

MINING IN THE RHODESIAS IN 1959

Copper production in Northern Rhodesia in 1959 was a record by value and amount. The provisional summary of production prepared by the Mines Department of the territorial Ministry of Labour and Mines indicates that the value of the annual production of all minerals was £125,531,579.

Copper values have been based since July 1, 1959, on free on rail at mine rates, and to make a comparison with the previous record total of £130,339,806 for 1956, a year in which copper prices were considerably higher, it is necessary to include amounts averaging about £1,000,000 a month since July 1, 1959, as an adjustment to the mean London Metal Exchange prices on which the 1956 figures were calculated. On that basis the 1959 production aggregated over £131,500,000. The 1958 figure was £77,225,327.

Last year's performance reflected a steep increase in the quantity of copper marketed from mines of the Anglo American and Rhodesian Selection Trust groups, and the use of additional refinery capacity to provide more metal of refined descriptions. The total of 364,595 tons of electrolytic copper, the value of which at £82,089,094 was about two-thirds of the figure for all minerals, was well above the previous record of 246,680 tons valued at £54,416,299 for 1957.

Although the companies concentrated on the quality product, output of blister copper was maintained at 165,543 tons valued at £34,945,876. Quantitively, the 1959 production of gold, silver, cobalt, manganese, selenium and limestone was also the highest recorded, as were the values of the output of gold, silver, cobalt, manganese and limestone.

Mineral production in Southern Rhodesia during January was valued at £2,021,000, an increase of 6 per cent on the comparable value in January, 1959, according to figures issued by the Southern Rhodesian Department of Mines.

Copper output at £193,000 was almost doubled from the previous January, reflecting the progress of M.T.D. (Mangula).

Asbestos mined during the month worth £593,000, was 12 per cent above the level for January, 1959. This was achieved by increasing output by over one-third to 11,768 tons.

Chromite valued at £277,197 from production of 51,436 tons was 14 per cent above the previous January level. Gold output remained relatively steady at 44,901 oz., valued at £562,954 — about three per cent down on last year. Wankie coal production amounted to 317,675 tons, of which 289,017 tons were sold for £294,909.

Tanganyika's Record Mining Year

THE continued steady progress of Tanganyika's mining industry is indicated by an increase last year of nearly £500,000 in the annual value of the minerals exported. For the first time the value of mineral production has exceeded £7,000,000. This record is slightly marred by the announcement that the end of productive life of the Mpanda lead mine is in sight, but it should not be assumed that this loss will not eventually be made up by the export of other minerals, states the Department of Mines in its review of 1959.

Exploration has continued in many parts of the country on a variety of deposits, and there is no indication yet of any slackening of interest in the territory's possibilities. The report of the World Bank Mission which visited the territory in the middle of the year should also help to highlight the potentialities.

Interest is being shown in the new low-cost explosive made by mixing ammonium nitrate with a small percentage of diesel oil. It is applicable chiefly to large quarrying operations, and experiments are being conducted at the Mwadui Mine of Williamson Diamonds Limited. During the year a revision of the legislation dealing with explosives was undertaken, and it is expected that it will be circulated to the industry for review during 1960, before being published as a Bill.

Diamond production was relatively low during the first few months of the year, owing to weather conditions, but in the end it exceeded that of the previous year and was valued at £4,540,000. For the first time since 1941, exports of gold bullion exceeded £1,000,000. The value of lead concentrates, which include valuable proportions of copper, silver and gold was slightly less than that achieved in 1958, and amounted to £94,000. These three products form the most important parts of Tanganyika's mineral exports, the total value of which was estimated to be £6,810,000, £470,000 more than the record 1958 figure. Other minerals exported during the year included salt (£114,000), mica (£52,000), tin concentrates (£50,000), and gypsum (£14,000). Exports of garnet, graphite, kaolin, lime, magnesite and meerschaum continued to be made on a small scale. The value of building minerals, coal, lime and salt produced and consumed within the territory was estimated to be £364,000 a reduction on the previous year's figure due largely to the smaller demands of the building industry.

Diamonds

At the Mwadui Mine of Williamson Diamonds Limited, which is responsible for 97 per cent of the diamond exports, important progress was made on the technical side. The mammoth 48 in. by 60 in. crusher proved of considerable help in handling the large granite boulders encountered in the gravels early in the year. From the bottom of the open-cast pit almost 4,000 feet of driving was completed in three adits located approximately 120 feet below the surface for bulk sampling at this horizon. A new prospect shaft was begun at the edge of the pipe designed to explore the deposit at greater depths. It had reached 632 feet at the end of the year. The programme of pitting and diamond drilling continued and the sampling plant (the former pilot mill) was kept busy throughout the year. The main treatment plant handled an average of over 6,600 tons per day.

At the neighbouring property of Alamasi Limited, the tonnage and weight of diamonds recovered showed an increase of one-third above the previous year, and a new treatment plant of more modern design was almost completed. On this mine also systematic evaluation of the ground was being attempted.

Gold

The principal mine in the country had a successful year, but the Kiabakari Mine of the Tangold Mining Company Limited, is responsible for the significant rise in bullion exports, surpassing the £1,000,000 mark.

At the Geita Mine, the largest gold mine in Tanganyika, the policy of operating at a reduced tonnage resulted in a higher gold recovery and increased exports. A working profit was achieved for the year. Work on oreblocks in the North End Extension to the Geita Mine continued, but the nearby property known as "Prospect 30" which had supplied ore for a number of years was nearing exhaustion.

The Kiabakari Mine in Musoma District, mentioned above, began production in February and, after the usual teething troubles milling settled down to a high degree of efficiency. Development and diamond drilling underground continued, to explore and increase the ore reserves. The company was also granted two Exclusive Prospecting Licences for gold in the district.

The Buhemba Mine, also in Musoma District, came under the direct managerial control of Williamson Diamonds Limited, and efficiency was improved in all departments. Elsewhere in the Lake Province there seemed to be a revival of interest in gold, and the three small worker prospects known as Kabasa, Kilimafeza and Rwamagasa were all receiving attention from European syndicates at the end of the year.

In the Chunya District, Ntumbi Mine maintained its production but development underground continued to be hampered by inflowing water. Machinery troubles also held up milling. Two small workers abandoned their attempts to make a living in this field, and those remaining reported that conditions were not getting any easier. The majority of the "diggers" working alluvial gold continue to be Africans, and other persons attempting this work generally find it uneconomic. From the 87 diggers on record, a total of 912 ounces of alluvial gold was sold to authorized dealers.

Lead Concentrates

At the Mpanda Mine of Uruwira Minerals Limited, work underground was concentrated on extracting ore from the remaining reserves, but development continued to explore all possible extensions of the ore zone both in depth and laterally.

Surface prospecting work, conducted by the company and the Department of Geological Survey, failed to reveal any new possibilities, and it became regretfully apparent that efforts to increase the life of the mine would not be successful. The board of directors announced that closure about the middle of 1960 must be expected. The treatment process was brought to a high degree of efficiency as a result of experimental work completed by the staff, and the mill operated at its normal capacity throughout the year.

Mica

There was a small but welcome increase in the amount of mica sheet exported, but the Jumbadimwe Mine in Mpwapwa District and the Kabende Mines in the Mpanda District closed down. The latter have been important producers for many years. The two African co-operative societies operating in the Uluguru Mountains were again responsible for the larger proportion of the mica sold to the licensed dealers. In Southe.n Highlands Province, Anglo-American Vulcanised Fibre Company Limited made progress in their efforts to establish themselves in the Tungwa area, exporting mica direct to their factory in London.

Tin and Niobium

The export of 65 tons of tin concentrates from the new mill of Kyerwa Syndicate Limited, is responsible for a notable rise from the Karagwe District. The smallworkers' operations were hampered by difficulties of water supply, their output of 28 tons approximating to that for 1958. Exploration work was undertaken by New Consolidated Goldfields Limited, on claims at Kafuro, and in an area of thirty square miles held under exclusive prospecting licence, but results were not encouraging for large-scale mining.

Throughout the year, the major effort of the Mbeya Exploration Company Limited, at Panda Hill, was directed to the solving of the problems of extracting the niobium-bearing pyrochlore from its host rock, carbonatite. The preliminary concentrates prepared experimentally in the pilot mill were exported to the Arnhem works of N.V. Billiton Maatschappij, the parent company, for further beneficiation. Until this problem is solved and an economic process developed no decision will be possible on the future commercial possibilities of this deposit.

Other Minerals

The territorial stocks of salt at the beginning of the year were more than twice normal, amounting to 11,781 tonnes. Nevertheless, production from the 12 coastal works which evaporate sea-water, and the two inland works which utilize brine springs reached a new record of 36,997 tonnes.

Exports of garnet continued from the deposits in Masasi District and the company carried out geological and prospecting work in an attempt to establish satisfactory reserves of the material for the future.

The gypsum deposits at Mkomasi in Lushoto District began to show signs of exhaustion and exports were reduced in consequence. Consideration was given to the development of the deposits in Kilwa District, which are of much better quality, but transport costs and communication difficulties prove to be a considerable hindrance.

The Tanganyika Corundum Corporation did further work on the ruby-corundum deposit near Longido, and a few small specimens of ruby were produced during the year. Efforts continue to find sufficient reserves of the corundum crystals and to interest possible buyers. Progress was maintained at the workings of the Tanganyika Meerschaum Corporation Limited, and 14 tons of crude material were exported to their Nairobi factory for manufacture into smokers pipes. Production from the territory's only coal mine, the Ilima Mine in Tukuyu District reached 2,194 tons.

Mineral Oil

The third deep test well in East Africa was completed by by BP-Shell Company at Mandawa in Kilwa District to a depth of 13,336 ft. The hole proved dry and the site was abandoned. During the remainder of the year operations have been confined to a series of seismic observations on the sea bed stretching from the Ruvumu River northwards and including the channels between the mainland and the islands of Pemba, Zanzibar and Mafia. For the moment, operations on the mainland are being concentrated in Kenya.

During the year, an Oil Exploration Licence covering two areas in Arusha District and aggregating 2,050 square miles was granted to Mr. Narshidas M. Mehta, and superficial examinations of the ground were made. The region is not one which at first sight appears a favourable possibility for oil prospecting.

Prospecting

The Western Rift Exploration Company Limited, continued the comprehensive examination of their 34,000 square mile exclusive prospecting licence. Geological reconnaissance mapping was extended northwards into Mpanda District, and a number of areas were examined in detail.

Williamson Diamonds Limited, also had a large force of prospectors in the field at the end of the year, working principally in areas of the Western, Lake and Central Provinces.

Considerable progress was made in the estimation of the reserves of phosphate rock discovered at Minjingu in Arusha District by New Consolidated Goldfields Limited, but it is becoming apparent that development will hinge primarily on the cost of transporting the material to the coast. Field tests are meantime being conducted by the Department of Agriculture. Another area which gives promise of revealing a deposit of a similar nature has been found by the Department of Geological Survey, who are examining the occurrence.

There has been a slight resurgence of interest in gold prospects, particularly in the Lake Province. The Overseas Geological Survey carried out airborne geophysical reconnaissance in the Geita District, the results of which are awaited and could prove of value for future investigations in this area. Mr. L. Bicchiere was endeavouring to arouse interest in the potentialities of the Iramba-Sekenke Goldfield, on which he has been the only worker for some years. He applied for an exclusive prospecting licence covering the whole of it.

The consumption of cement in Tanganyika is approaching that which could support a factory of economic size, and interest revived in the possibilities of finding a suitable site. Several inquiries were received, and the Tanganyika Portland Cement Company Limited, an associate of the East African Portland Cement Company Limited of Mombasa, began an examination of deposits of limestone and clay in the Bagamoyo District. Pitting and diamond drilling is being carried out to attempt to define adequate reserves of the raw materials.

At December 31, 1959, there were 554 Prospecting Rights current of which 200 were held by Africans. In his speech to the Legislative Council in December, His Excellency the Governor announced that courses would be run by the Department of Mines to encourage African prospecting, and a decision was taken to hold the pilot course at Morogoro early in 1960.

Laboratory Investigations in the Nickel Smeltery

By C. C. Downie

THE laboratory of the nickel smeltery occupies an important category, not only simply as a means of ascertaining percentage compositions of the various commodities, but for undertaking all associated work-tests, besides research on proposed improvements. This relates to blast-furnace smelting and converter practice for the production of refined nickel matte, and cobalt-nickel matte.

The work differs appreciably from that at smelteries handling copper-nickel materials, which has been described elsewhere, and which win the metals in a more indirect manner. With ores of the garnierite and dunite order, efforts are made to have these so fluxed and briquetted that smelting proceeds without interruption for 7-day weeks over a very lengthy period.

Chemical analysis of these ores for nickel contents requires to be very exacting, as large consignments arrive from distant parts and each ship-load has to be sampled by a neutral authority. With ores containing some 8 per cent nickel, the analysis has to show the nickel correct to 0.001 per cent, as confirmed by a public analyst, besides being further checked by samples being sent to the Continent. For works tests, it suffices for such analysis to be correct to 0.01 per cent, although using the same methods. All nickel determinations are carried out electrolytically, with platinum cones for the deposition, and which are simply ramifications of the method originally worked out by E. F. Smith. The familiar dimethyl-glyoxime process is only employed for some products, e.g. blast-matte, speiss-matte, nickel-cobalt blast matte, and slag, but not for refined mattes from the converters, as here again the electrolytic method is resorted to.

Numerous methods have been described in standard works on analysis, but their adaptation for particular uses is not always made clear in the necessary detail. Thus, with refined matte of 70 per cent nickel, the roasted oxide, and the metal itself, there appears to be no alternative to the slow electrolytic system, despite the advent of spectograph and photometer adaptations, etc.

The dimethyl-glyoxime process is always useful as a rapid determination, although the initial procedure has to be varied somewhat in view of existing impurities — the familiar addition of tartaric acid with ammonium hydrate for high-iron, poor-nickel materials, and acetic acid in presence of chromium and high manganese contents. Very much the same remarks apply in determining cobalt contents, since, while the nitroso-beta-naphthol method attracted no little attention in technical training centres, it is likewise not considered sufficiently accurate for either large or small quantities in the smeltery, and electrolytic deposition is again preferred.

Both of these methods, the dimethyl-glyoxime, and nitroso-beta-naphthol processes, are sometimes taken advantage of for slag analysis, but more recently the nitroso-R-salt colorimetric method has been adopted for cobalt determinations. This can show the presence of cobalt in a concentration of one or more parts per 30,000,000 of solution.

Another of the recent, but less successful methods involves the use of phenyl-thiohydantoic acid, which is claimed to determine cobalt in the presence of a wide range of rare metals, but which has been open to some criticism. The only appreciable difference in handling the different products for full analysis is in the initial opening-up. Formerly, with some of the silicate materials, there was no alternative but to resort to the tedious initial fusion and extraction, but experience with a number of them revealed that following a simple preliminary treatment and fine pulverizing, they could be decomposed with aqua regia, without the need for hydrofluoric acid. This proved a considerable saving in time, since although methods culled from vitreous enamel factories using hydrofluoric acid were tried out, the continual need for platinum vessels tended to offset the advantages.

Mattes, Toppings and Slags

With ordinary wet analysis, it was found that the solution of mattes and speiss-matte, besides pyrites containing nickel, although sometimes easily dealt with by nitric acid and aqua regia, were not infrequently unduly slow. Resort had sometimes to be made to the earlier style of preliminary roasting, details of which appear in publications on assaying. Some nickel mattes are exceedingly hard and take long to pulverize, and in one instance a miniature Krupp mill was installed in the laboratory. For works purposes, small broken pieces when roasted are more easily pulverized, and following this roasting, pass into solution without difficulty (sometimes in nitric acid without any additions), an advantage which is best seen where large numbers of samples have to be dealt with simultaneously.

In the process, the use of blast-roasting raises the product from poor ores (i.e. matte of 15 per cent nickel or less) up to some 30 per cent, suitable for the converter, while the normal rich blast-matte continues in its usual way to the converter, and which necessitates a duplication of analysis. In the converter, the toppings take off any little copper which may be present, to provide copper-free matte, containing around 70 per cent nickel. Hence the daily laboratory work comprises estimating nickel from the different items using samples of 0.5 gm. or 1 gm., according to what percentage is normally expected, but otherwise carried out in the same way.

As a rule, the refined matte is fully analysed for nickel, arsenic, iron, copper, sulphur, and cobalt, besides manganese and chromium. The latter two only appear occasionally, and the copper and cobalt contents are checked by colorimetric methods. The toppings are not tested in regular runs, until the refined matte itself shows indications of some fractions of copper (Researches showed that occasionally the silicate toppings from ganister additions could contain minute copper contents, as distinct from the main removal by salt-cake additions). Blast-matte, on the contrary, is only quickly tested for iron and nickel contents, unless something goes wrong with the output.

Converter toppings are very variable in composition according to the particular stage at which they have been taken off, and with a steady run, and without contingencies arising, are allowed to accumulate. With work proceeding satisfactorily, they are then fully analysed weekly. This, of course, differs from where variable ores are dealt with, when the toppings have to be analysed each shift.

Nickel-cobalt mattes, particularly since improved fluxes have introduced better procedures, have necessitated the cobalt, arsenic, and copper contents to be assayed in the toppings for each " blow ". The earlier style of allowing the arsenic virtually to dominate the situation has been dispensed with. This relates to the old method of balancing arsenic and iron contents so that in the subsequent wet process, following per-oxidation, arsenate of iron was ootained in relatively large proportions, incidentally carrying some cobalt with it.

Improved working brings the arsenic contents from several per cent down to 0.5 per cent, and some iron, more than can be precipitated, is purposely left to account for rare metals. Blast furnace slags are daily analysed for the usual silica, iron, lime, baryta, alumina, and magnesia, and less frequently for oxides of manganese, chromium, and titanium, alkali, and sulphur. The results of these analyses are balanced against the briquette and flux additions to the furnace, and in view of the large charge, 200 tons per 24 hours, the slags are always under close scrutiny. Instances arose where slags containing high chromium contents necessitated the results of this, and also magnesia, to be estimated every few hours, to facilitate simple control of the charges. Sampling is rendered easy, since the slag is continuously run to a water-pit for ultimate conversiòn to high-grade tarmacadam, and for other building purposes. In view of its high physical qualities, this grained-slag was much in demand, even for fortification purposes.

Ancillary Materials, and Tests Undertaken

Gases emanating from the blast furnaces and converters are passed to scrubbers, and were daily tested for sulphur and arsenic contents before installation of continuous automatic recorders. In view of the vast consumption of water for cooling purposes, which hailed from a nearby canal, use had to be made of a water softening plant, which, so far as analysis was concerned, was only attended to periodically. Probably more attention is paid to the composition of the coke used than in any other smelting enterprise, because of the high temperatures required to handle refractory ores.

Calorific value is determined by the bomb calorimeter method, and the contents of carbon, hydrogen, oxygen, sulphur, and ash are determined within the closest tolerances. This differs from the proximate analysis which suffices elsewhere. Barytes, gypsum, and salt-cake are usually only analysed as consignments arrive, for sulphur alone, unless some contingency warrants a fuller investigation. Although ganister, refractories, and furnace linings, as obtained from outside concerns, were only periodically examined, as a small pottery was included in the smeltery, all clays, etc., used in making spouts, nozzles, and converter blocks, were kept under close analytical control, using conventional methods. Works tests included the measurement of flow of gases, their temperature at different points, and the flow and temperature of water to the water jackets. The layout included a 200 ton, a 100 ton, and two 50 ton furnaces, the first of which had 28 blast-jackets in two tiers. Hence the matter of flow and temperature of the water, in view of the high furnace temperatures attained, was of primary importance, as a comparative check against coke consumption.

Where fresh consignments of ores came to hand, laboratory tests of briquettes were facilitated, since in the works each of the large briquetting machines was equipped with its independent grinding mill and connected bucket-elevator arrangement, as a complete unit. In this way, briquettes from highly refractory ores containing appreciable chrome and magnesia contents, which formerly were considered only suitable for electric smelting, could be conveniently balanced one against the other, ultimately fluxing the mass to a relatively easily fusible product. Other smelteries lacking corresponding ranges of independent briquetting-and-grinding units, were much more liable to experience the mass sticking in the hearth. With the foregoing briquetting system, where batches of briquettes were of appreciable difference in composition, as made up from laboratory analysis, they were given chalk-marks to facilitate handling on the charging floor, and ensured months of continuous smelting without interruption.

Where some of the ores showed a declining nickel percentage, to " reinforce " the concentration methods mentioned, additions of scrap nickel, old anodes, and sheets from dismantled chemical plant were made to the blast-matte, but which were analysed only for nickel contents.

Other Investigations

Where the ores were almost copper-free, as transpired at one period, small additions of cupro-nickel alloys and Monel were likewise made to the blast-matte, as the regular process took care of this minute copper proportion introduced. This differs from the system of converting such alloys to sulphates of copper and nickel by smelting to matte and subsequent wet extraction, but, as purchased, little if anything is paid for the nickel content. Analysis for these metals follows existing methods used in engineering laboratories. In other directions, the platinum metals appeared in exceedingly minute proportions in furnace accretions, mainly iridium, and also where some speiss-mattes were formed, which were disposed of to a Continental firm for extraction, while their assay was done by a public analyst. (A detailed account of the analytical method used appears in *The Mining Magazine* London. February, 1939. — " Assay of the Platinum Metals.")

Another smeltery of the same company, located in the Far East substituted electric shaft furnaces for the blast furnace. Since there are virtually no limits to fusibility under the electric arc, the most highly refractory ores could thus be smelted, with but little knowledge of fluxing conditions, which suited the available native labour, but despite acquiring current from a nearby hydro scheme, it took many years before results came up to expectations. Lastly, a further nickel organization experienced such difficulties with high chromium contents, that, instead of making a fine-art of fluxing conditions etc., the ores, hailing from the Middle East, were first subjected to calcining with dolomite materials for wet extraction of the chromium, followed by smelting of the insoluble residue to win the nickel. This will give some indication of the elaborate character of the foregoing fluxing, briquetting, and smelting conditions, which throughout were maintained within the closest analytical tolerances.

Mining in Pakistan—II

CHROMITE AND NATURAL GAS

By C. HARVEY RICHARDS, A.C.S.M., M.I.M.M.

PAKISTAN chromite is classified as metallurgical grade. Since 1903 the main centre of chromite mining has been Hindubagh, some 80 miles north-east of Quetta. Other deposits have been found further east at Fort Sandeman, also in the Kharan district on the south side of the Ras Koh mountain range well to the west of Quetta. As far as production is concerned over 80 per cent of chromite comes from the Hindubagh area, and most of that from the operations of the Pakistan Chrome Mines Ltd. These were under the name of Baluchistan Chrome Mines before Partition.

Hindubagh is served by a 2 ft. 6 in. gauge railway line which is continued on to Fort Sandeman. The capacity of this line is very limited, and the chromite traffic is restricted by the small number of bottom dumping wagons provided for it. All ore has to be shipped at Bostan station, 20 miles from Quetta. The bottom dumper wagons discharge on to a platform whence the ore is hand-loaded into closed wagons of the broad gauge line, by baskets. Any ore from Fort Sandeman travels the same route. The capacity of this line, for chromite, is considered to be 2,500 tons per month, on the average. Hindubagh lies in a wide valley at about 6,000 ft. and the mountains on either side rise to 8,000 ft. and over. The chromite workings are in the mountains, and the ore is brought down via narrow tracks just wide enough for a lorry, to loading platforms beside the railway. Spur lines are taken as near to the mining area as possible, but haulages of up to 7 miles are necessary by road transport.

The mining operations are much as they were when started early in this century. When an indication of chromite is found on the hillside, it is followed into the hill by a small adit. The local experience is that, although an outcrop may be of low grade ore, the grade invariably gets better on penetrating into the hill. If this improvement does not take place within 20 to 30 feet, it is abandoned, and another started nearby. These adits are very small, and only enlarged when improvement in grade shows. The adit is then enlarged to admit a small donkey. In the whole area all ore is brought to surface on the backs of these donkeys, in paniers of sacking. Practically all these donkeys have their nostrils slit on the assumption that it helps the animal to breathe more freely. In opencast workings, these animals climb up and down over steep zig-zag paths cut into the sides. Most of the ore is from underground workings, at the moment, and the size of these can be imagined when the group of mines producing about 2,000 tons per month have over 90 " mines ".

This has arisen from the fact that Hindubagh is in tribal country. The tribesmen claim grazing rights all over the territory, although the amount of grazing to be had on the precipitous slopes of the mountains is sparse. Should any new adit strike good ore, it is not long before there is someone claiming that the mine is on his piece of tribal land, and therefore it is his mine. Due, no doubt, to the fact that in the early days, any dispute of such a claim might lead to a tribal disturbance, these claims have been allowed, when substantiated by the local tribal council. They still persist, and these tribesmen are considered to be the owners and claim the right to do what they wish with it. They can give it away, as a dowry, or to a friend, or they can sell it. The company has no control over it. One man may control more than one mine in this way. The actual mining operations are the responsibility of the company, but under the prevailing conditions, they find that issuing instructions is one thing and getting them carried out is another. Cases are quoted where an owner, or his contractor, has been forced to do certain work, by the company official, and the owner has taken the matter to the tribal council and claimed that he was forced to spend money unnecessarily, and the company has been considered to be in the wrong.

Until this state of affairs is rectified, no one can plan proper development and extraction of the ore, and so production is restricted to its present tonnage. If the production was increased, road transport could augment the light railway, as the road to Quetta is a good one. Production falls during winter when there is heavy snow " because there is no grass for the donkeys " !

The chromite in the Hindubagh area is divided into two main zones, one predominantly high grade, and the other mainly of lower grade. In the first zone the grade runs to over 51 per cent Cr2 O3, with Cr. : Fe. ratio of better than 3 : 1, while in the other zone the grade is from 43 - 47 per cent Cr2 O3 and the Cr. : Fe. ratio from 2.6 : 1 to 2.8 : 1.

One of the drawbacks of the Baluchistan chrome ore is the high fines content. This is caused by the considerable number of times it is handled between mine and ship, and the use of the 80 per cent gelignite in the mines does not help to lessen it. However, the mine owners are not easily persuaded that a lower percentage powder will work as well, and to try and force them to change might precipitate a " tribal disturbance ".

Lack of mining equipment is very obvious, and this again is due to lack of foreign exchange in the past. There is some hope that this might improve in the near future.

Petroleum and Natural Gas

The production of petroleum is practically confined to the Attock area, which lies to the north of the Salt Range. Average daily production is in the neighbourhood of 5,000 barrels. A new hole brought in in this region recently is reported to produce from 800 to 1,000 barrels per day. Prospecting for oil is being carried out in many parts of East and West Pakistan.

In 1952, while drilling for oil at Sui, Pakistan Petroleum Co. Ltd. struck natural gas at about 4,300 ft. Further drilling confirmed the existence of considerable reserves of this gas, and a pipeline 347 miles long of 16 in. diameter, was constructed to convey this gas to Karachi. The gas is of high calorific value, and requires little purification. Its use is now widespread and the name Sui-gas is used generally throughout the country to denote any natural gas. Natural gas has since been proved to exist in other areas without oil, and is found in the Attock area with oil. In 1955 gas was struck in Sylhet in East Pakistan, and this was found to be of better quality than the original gas at Sui. From time to time figures have been published in the Press indicating practically inexhaustible reserves of natural gas, and reports are current regarding the possibilities of exporting this gas in liquid form. Whatever truth there is in this suggestion, there remains the possibility of exporting this gas across the border to Bharat, by pipelines should the time come when trade between the two countries is unrestricted.

(To be concluded

Technical Briefs

Metallic Ore Processing Technique

A new method of effecting thermal separation of dissolved or suspended solids from liquids, which has been proved, at least experimentally, to be applicable to a variety of processes, including the direct reduction of iron oxides to native iron powder, the extraction of sulphur from iron pyrites, the production of uranium oxide from uranyl nitrate and other metallic ore processing requirements, has been developed by the Pulp and Paper Research Institute of Canada.

Known as the Atomised Suspension Technique (AST), it was invented by Dr. William H. Gauvin, head of the Chemical Engineering Division of the Institute and is now moving from the experimental to the practical stage of development, having so far been more particularly tried out for the purpose of treating municipal sewage wastes.

Patents in respect of the process have been granted to the Canadian Pulp and Paper Research Institute in Canada and the United States and seven other countries and patents are pending in six other countries. The Institute has entered into co-operative agreements with a number of engineering firms who have been granted non-exclusive, royalty-free licences to use the AST technique at the laboratory or pilot plant stage. Royalty amounts payable in respect of industrial plants constructed have not yet been fixed, but each co-operating firm is to be allowed to build its first commercial unit royalty-free. All Canadian municipal sludge treatment plants will be free from royalties. One of the firms interested in the new technique is The National Welding Co., of Montreal, which has already built a sewage treatment plant now in permanent operation at Beaconsfield, Quebec.

Involved in the new technique is the spraying of the solution or slurry to be treated through an atomising nozzle into a heated reactor and, within the reactor, effecting a series of physical and chemical transformations in a continuous operation. Normally, the first step would be thermal separation of the solids by evaporation and this might be followed by chemical treatment of the solids in several phases at fairly high speed.

Pre-evaporation reduces the evaporation load on the reactor by increasing the solids concentration of the feed and this can be effected by the use of the waste gases from the reactor jacket or from within the reactor. The required consistency having been achieved, the solution is sprayed through the atomising nozzle in the head of the reactor, the walls of which are maintained at the required temperature. Wall temperature at start-up would be achieved by external heat source, but this would be discontinued when the combustibles recovered from the process can maintain the required heat. Temperature would diminish from the top to the bottom of the reactor and throughout the reactor, though zones of various heat intensity could be incorporated. Since no air or gases are introduced at the head of the reactor, there is no gas film surrounding the droplets produced by atomisation and the rate of heat transfer is high and and evaporation rapid. The violence of evaporation causes deep pits and cracks to appear on the surface of the particles, thereby increasing the heat transfer efficiency.

As the suspension moves down the reactor, the droplets become semi-solid particles and enter a drying zone where the internal moisture of the particles diffuses to their surfaces and is evaporated. At the end of the drying zone physical separation of the solids in the feed has been achieved, but further heat treatment may still be necessary in some cases.

After treatment within the reactor, the solids may be extracted from the vapour stream in a cyclone collector, and also, if necessary, with a scrubber.

High pressure steam from the reactor may be converted to lower pressure process steam; condensed steam may provide hot water for space heating. The gas stream may also be used, prior to condensation, within the AST system. If combustible gases are produced in the reactor they might be burnt in a furnace to provide heat for the reactor. Heat from such gases could be recovered in a waste heat boiler.

The general industrial advantages of the Atomised Suspension Technique, including, as they do, simplicity of equipment, high reaction rates, absence of corrosion, good heat recovery, ease of control and the possibility of re-use of water, appear to be very attractive.

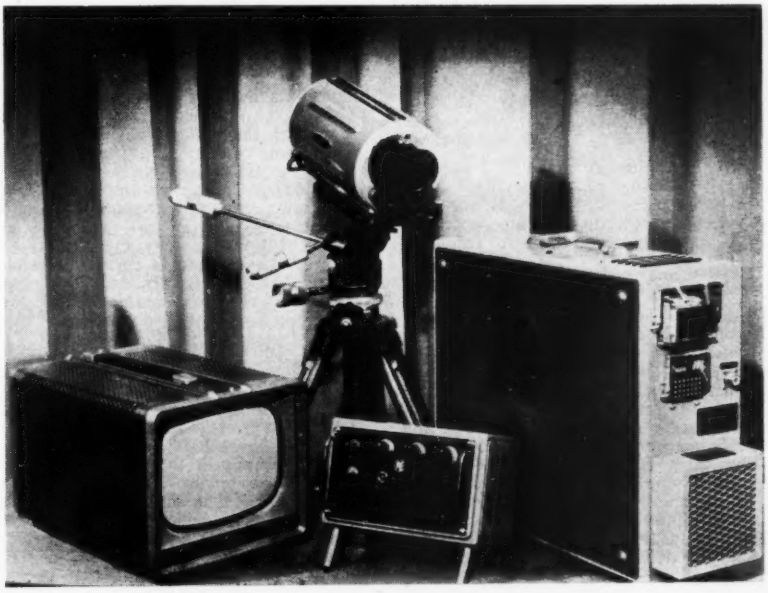
TUNGSTEN-MOLYBDENUM SEPARATION PROCESS

Fused-salt-bath electrolysis, a new and simpler method recently developed by the U.S. Bureau of Mines for selectively extracting tungsten and molybdenum from domestic mineral concentrates, is described in a technical publication just released by the U.S. Department of the Interior.

The process, which has aroused wide industrial interest, promises to reduce costs of producing acceptable-grade tungsten and molybdenum-metal powders from scheelite concentrates containing both metals. Heretofore, separation of the molybdenum from such concentrates required expensive treatment.

The Bureau's report covers in detail its laboratory work and bench-scale experiments in which commercial-grade tungsten and molybdenum powders were selectively recovered from typical scheelite concentrates in a one-step operation. The publication was written by J. B. Zadra and J. M. Gomes, metallurgists at the Bureau's Reno (Nev.), Metallurgy Research Centre, where the studies were conducted. Report of Investigations 5554, "Electrowinning Tungsten and Associated Molybdenum from Scheelite," can be obtained from the Bureau of Mines Publications-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. Requests for the report should include its number and title.

A versatile closed circuit television service, providing specially designed installations for individual needs, is now being marketed throughout industry and commerce by Rank Precision Industries Ltd. Several hundred industrial or commercial applications already exist. Problems of visual communication can be solved in varied fields including mining. The equipment which forms the basis of individually designed installations consists of a camera (rear); camera control unit (right); camera control panel (centre) and monitor screen (left). The camera is 11 in. long and weighs 7 lb.



MINING MISCELLANY

The Ministry of Economic Affairs in Formosa has drafted a working plan for the mining industries for 1960, divided under the headings of coal mining, sulphur and pyrite mining and gold and copper mining.

★

We have received a report to the effect that copper wire, which must be imported from abroad, is being replaced in the mines in China by iron wire of local manufacture as material for overhead lines for electric trolleys. Though developed in the first place, for use in iron mines, seven of which are now wired with it throughout at a saving estimated at 120,000 yuan (on about 70 miles of wiring), it is to be adopted also in coal mines. Because of its higher resistance, iron wire could only be used in situations where the density of traffic was not very heavy. The report adds that where heavier traffic is involved, the iron wire is supplemented by a subsidiary line of aluminium wire.

★

Provisional figures of Venezuela's asbestos production indicate a big reduction from 8,267 tons in 1958 to 4,622 tons in 1959. The entire output—the lowest for four years—comes from the Tinaquillo mines of the Amianto de Venezuela Co., in the State of Cojedes.

★

According to a Gazette Notification from Pakistan, the Geological Survey of Pakistan and the Department of Petroleum and Minerals have been merged with the Bureau of Minerals. The function of these departments, as well as those of the Fuel Directorate of the Department of Supply and Development in regard to the development of coal resources, have also been transferred to the Bureau.

★

The Cuban Prime Minister, Fidel Castro is reported to have stated, during a television speech, that he intended using Russian plant and equipment for exploitation of Cuba's rich mineral reserves. The building of a 500,000 tonne steelworks is to start there shortly.

★

The Geological Institute of the Israeli Ministry of Development is to adopt geo-chemical methods for subsurface prospecting. The necessary equipment has been ordered from the U.K.

★

At a four-day symposium held at the National Metallurgical Laboratory at Jamshedpur, India, recently on pilot plants in metallurgical research and mineral development, the main subjects were the search for substitutes for constituents of alloy compositions not available in India, and aspects of the processing and upgrading of Indian ores. Among various processes which the laboratory has been developing, is one claimed to enable manganese ore with only 15 per cent manganese content to yield manganese metal of 100 per cent purity.

Yugoslavia is planning to take part in the exploitation of mineral ores in Afghanistan. This is part of a pact under which the two countries will exchange goods and services, and Yugoslavia will supply Afghanistan with mineral and industrial products.

★

The new plant of Espanola de Cinc, near Cartagena, Spain has recently been completed, and production is expected to begin shortly with the treatment of 40,000 tonnes annually of blende for the production of 20,000 tonnes of high quality zinc and 36,000 tonnes of sulphuric acid monohydrate. The plant is expected to be producing to capacity by the middle of 1960, and at a later date is planning to process the metal produced.

★

The Belgian Congolese manganese ore company, Bécéka-Manganèse, reports production last year of 280,000 tonnes of exportable manganese, compared with 320,000 tonnes in 1958 and 350,000 tonnes in 1957. The firm's total exports during 1959, which included stocks, were 290,000 tonnes.

★

The American-Hellenic Mining Development Corporation, based in Greece, has signed a contract to sell 25,000 tonnes of Greek bauxite to the Soviet Union during 1960. Payment for the bauxite will be 80 per cent in currency and 20 per cent in Russian machinery.

★

Iron ore reserves recently discovered in the Syrian part of the United Arab Republic are now estimated as having between 25 and 50 per cent iron content, indicating a total iron content of some 16,000,000 tonnes.

★

On February 15, states a report from Washington, the House approved a Bill which authorizes the Secretary of Interior to set up a special office to contract with State, local and private organizations for research "to encourage and stimulate the production and conservation of coal". The legislation authorizes a first-year appropriation of $2,000,000, but the Interior Committee report on the Bill envisages a 10-year programme beginning July 1, 1961, with total expenditures in excess of $50,000,000. The report emphasizes that the new research programme should supplement—not replace—present long-range coal research by the Bureau of Mines. The Bureau is currently spending $7,200,000 annually on bituminous and anthracite coal research, and the President has requested $7,500,000 for this purpose in his 1961 message.

★

The government of Andhra Pradesh, India, has sanctioned a scheme, estimated to cost Rs. 78,000, for coal drilling operations in the Godaveri valley, where coal seams were disclosed as early as 1875. The scheme envisages the boring of three holes each 1,000 ft., in the more promising areas. It is expected to strike coal seams of five to seven ft. thickness within 600 ft. depth.

A new method of exploring for and draining off firedamp which will end the possibility of firedamp explosions during tunnelling, has been introduced in the Nantung coal mines, near Chungking, in south-west China. Devised by a Nantung miner, it involves the use of hydraulic pressure for exploring and draining firedamp. Other innovations used in the Nantung mines are the use of pit props made of clay, or of powdered slag mixed with lime and gypsum, or of compressed coal dust mixed with suitable ingredients. Being cheaper than wooden props, which are sometimes in short supply in China, these props are reported to have a greater resistance to pressure and weigh less than concrete. Their manufacture is extremely simple. Also in use in the Nantung mines are small electric locomotives for underground haulage.

★

The Venezuelan Minister of Mines and Hydrocarbons, Dr. Perez Alfonzo, has stated that investigations are to be carried out to ascertain the commercial possibilities of the large bauxite deposits in the State of Guayana.

★

An aerial survey has recently been completed over 600 sq. miles around Avoca, Eire, by the South East Ireland Syndicate, a company formed in Canada by seven Canadian and U.S. mining concerns, including Consolidated Mogul. New mineral tests, taking about three months, are to be carried out by geologists and geophysicists, and will take about three months to complete.

★

The Austrian government is considering doubling the customs tariff on fuel oil imports and restricting imports of coal and fuel oil in the near future. The authorities are also drafting a mining promotion law to come into force at the beginning of 1961, introducing a special duty on the consumption of fuel oil, natural gas, electricity and foreign coal coke. Revenue from this duty is to be used for granting financial aid to Austrian mines. In 1959, Austria's coal production was cut by nearly 300,000 tonnes to about 6,350,000 tonnes, including 150,000 tonnes of hard coal, and at the beginning of this year, unsold coal stocks totalled nearly 400,000 tonnes. Sales prospects are not expected to improve in 1960 owing to the trend against the use of coal.

★

It is reported from Melbourne that Ravensthorpe Copper Mines were unable to accept the offer made by a Japanese smelting group of financial participations, as the terms were considered unacceptable.

★

Heavy deposits of lead sulphide with a high percentage of metal, which are believed to contain 10 per cent silver, have been found in the village of Binjam, in the Bastar district of India. Samples of ore collected have been sent to the Raipur Mining College for final analysis.

A total of 11,767 tonnes of iron ore were produced in Lower Saxony, West Germany, during 1959, 1.9 per cent more than in 1958, despite current difficulties in the local iron ore industry. About 65 per cent of all iron ore produced in West Germany now comes from Lower Saxony, where the Siegerland deposits are situated. Total output of copper, lead and zinc in the Land over the year is given as 582,000 tonnes, or 6.7 per cent more than in the previous year.

*

Copper production from the Timna plant in Israel is expected to total 5,400 tons of electrolytic copper by March 31 next, its first full year of operation, said Mr. E. Bodenkin, director general of Israel Mining Industries, and will then reach about 90 per cent of planned capacity. Almost all the output, including 660 tons produced during the running-in period, have been exported to West Germany and Brazil. Improvements planned should increase the capacity to 6,500-7,000 tons of electrolytic copper per year. Mining is at present open pit, but two underground mines are now being started, and opencast operations are to be discontinued next year. The company is studying plans for constructing a copper smelting plant in order to market blister copper.

*

World Bank reports the signing of a loan at the end of 1959, to Empresa Nacional de Electricidad S.A., and Corporacion de Fomento de la Produccion, for $32,500,000 (25 years 6 per cent), for the development of electric power in Chile. The loan will cover the foreign exchange requirements of a hydroelectric plant in Central Chile and a thermoelectric plant at Huasco, in norther Chile, with a capacity of 15,000 kW. The latter plant is to supply power particularly to the iron ore, copper and manganese mines in the area. The development of high-grade iron ore for export has been accorded high priority.

*

The Jordan Phosphates Mines Co. produced 337,000 tons of phosphates in 1959, most of which was exported. Difficulties were experienced over transportation, and also in finding markets. The company made an agreement with the Yugoslav firm, Yugometal, in September last whereby the latter were appointed management consultants to the phosphate company. In November the company was granted a commercial loan of $1,500,000 from the Development Loan fund to help expand their Ruseifa mines, and to finance a survey of deposits in the El Hasa district, south of Amman.

*

In March, 1958, Bulgaria secured two contracts from China for the installation of plants for the extraction and concentration of lead and zinc, plans and estimates for which were prepared by the government organization "Minproekt". The first of these contracts were completed on February 24 this year. The mine is situated at Si-din, in the Kwangsi-chuang Autonomus Region, South China, and comprises two underground workings and one opencast operation for the extraction of lead-zinc ore. The flotation plant is capable of handling 400 tonnes of ore daily, from which will be extracted 15-20 tonnes of lead concentrate and 80-90 tonnes of zinc concentrate. The whole of the plant and equipment for this undertaking, which is reported to be highly mechanised, were made in Bulgaria. "Minproekt's" second contract is for a mine in the province of Liao-ning, in north-east China, which will be equipped on similar lines to that at Si-din, but for a capacity of 1,000 t.p.d.

Personal

Mr. R. Turner, acting managing director of Powell Duffryn Technical Services, has joined the board of Powell Duffryn Carbon Products as deputy chairman. Mr. F. W. Stokes, a director of Powell Duffryn Carbon and works manager of the company's factory at Hayes, has been appointed general manager. Mr. Barrie Heath, managing director of Powell Duffryn Carbon Products and a director of other companies in the group, has relinquished these appointments to take up another post.

*

Mr. Ed. Drott, president of the Drott Manufacturing Corporation of Wausau, Wisconsin, recently returned to the U.S. after a two week visit to Britain, where he attended an overseas sales conference of over 100 delegates of International Harvester distributors from 26 countries at Harrogate.

*

Mr. Norman Readman, managing director of The Pneumatic Tool Co., a wholly-owned subsidiary company of Chicago Pneumatic Tool Co., of New York, has been elected to the board of directors of the New York parent company. Mr. Readman remains managing director of the Consolidated Pneumatic Co., in London, and from there continues to be responsible for all Chicago's Pneumatic's operations throughout the world, outside of the Western Hemisphere.

*

Richard Sutcliffe of Horbury announce the appointment of Mr. Matthew Reid Moore as general sales manager.

*

International Minerals and Chemicals Ltd., London subsidiary of International Minerals and Chemical Corporation, of Skokie, Illinois, announce the appointment of Mr. C. F. H. Cufley as their shipping advisor.

*

Sir John Wrightson, Bt., chairman of Head Wrightson and Co., has left for a month's tour of South Africa and Southern Rhodesia to visit the company's works and business interests.

*

Dr. G. A. Schnellmann has returned from a professional visit to India and Persia.

Russian Trade Bodies' Addressess.—A new full list of names and addresses has been issued of the foreign trade organizations of the Soviet Union, which control export and import of particular products and materials. They include:

Avtoexport (exports geophysical apparatus, certain measuring apparatus and vehicles), Moscow G-200, Smolenskaya-Sennaya 32-34.

Machinoexport (exports mining equipment and plant and metal refinery and furnace equipment and plant) and Machinoimport (imports compressors and electro-technical items), Moscow G-200, Smolenskaya-Sennaya 32-34.

Priborintorg (imports automatic-control plant), Moscow G-200, Smolenskaya-Sennaya 32 (n.b. not 32-34 as above).

Promsyryoimport (imports and exports ferrous metals, semi-products and products), Moscow G-200, Smolenskaya-Sennaya 32-34.

Rasnoexport (exports and imports mica inter alia), Moscow K-6, Kalyayevskaya 5.

Rasnoimport (exports and imports non-ferrous metals, alloys, ores, concentrates, foils and powder), Moscow G-200, Smolenskaya-Sennaya 32-34.

Soyuspromexport (exports and imports non-metallic minerals of all types, also iron ore, manganese ore, chrome and precious metals), Moscow G-200, Smolenskaya-Sennaya 32-34.

Stankoimport (exports and imports of foundry and rolling-mill equipment, measuring and geodetic equipment inter alia), Moscow G-200, Smolenskaya-Sennaya 32-34.

Technopromimport (imports certain measuring instruments inter alia), Moscow G-200, Smolenskaya-Sennaya 32-34.

Tyazhpromexport (exports and imports equipment for metal and coal plants inter alia), Moscow G-200, Smolenskaya-Sennaya 32-34.

Direct Reduction

Engineers and scientists in many countries are interested in the possibilities of alternative methods of producing iron. Several direct reduction techniques have been evolved with varying degrees of success, and research continues on a very extensive scale.

While the blast furnace is a remarkably efficient method of making iron, it has certain limitations. Construction involves very heavy capital charges; operation has to be maintained for long campaigns, output levels being variable only within certain limits; furthermore the process involves the consumption of large quantities of high grade metallurgical coke, expensive in itself and representing additional handling costs.

Direct reduction would appear to go some way towards overcoming these limitations. On the whole, the necessary plant is much less monolithic; operation can be interrupted and re-started with relative ease, introducing a hitherto unattainable degree of flexibility in production planning, and coke of lower quality and/or less volume is employed. Theoretically, at least, the economics of direct reduction would appear to present interesting possibililities.

The international conference on direct reduction organized by the Electrochemical Society of the U.S.A. at Chicago over May 2 to 5 should therefore arouse considerable interest. Twenty-one papers are scheduled, reviewing progress in Canada, the United States, Great Britain, Sweden, France, Germany and Norway.

Further information is obtainable from Dr. R. R. Rogers, Mines Branch, Department of Mines and Technical Surveys, 552 Booth Street, Ottawa, Canada.

Metals and Minerals

Suspension of Cobalt-Nickel Operations at Moa Bay

Last week (pp. 263 and 264) we discussed the outlook for Cuban nickel in the light of the Castro Government's repressive treatment of foreign mining companies. It has since been announced that the Freeport Nickel Co. plans to suspend operation of its $75,000,000 nickel-cobalt mine and concentrating facilities at Moa Bay. In making this announcement, the company stated that the new Cuban mining law and other recent Cuban developments had made the suspension necessary.

In November President Dorticos of Cuba was informed that, because of the provisions of the new Cuban mining law, the company was no longer able to obtain funds previously arranged for and needed to complete construction and attain commercial production. It was explained that, unless the necessary money could be obtained, the entire project would have to come to a halt. Talks were held with a number of Cuban Government officials, but no agreement could be reached.

The project called for an estimated investment of $119,000,000, of which about $75,000,000 was to be invested in Cuba. Although not yet in full production, it is employing about 1,500 Cubans. At full production it would provide over 1,000 permanent operating jobs, and would be one of Cuba's largest taxpayers.

And so, unless the Cuban Government has second and wiser thoughts, political fanaticism, by shutting down a project developed at a great expenditure of time and effort to supply 25,000 s.tons of nickel and 2,200 s.tons of cobalt annually, will deprive the island of a most lucrative source of employment and revenue which, one would have supposed, it could ill afford to lose!

The mine has been conducting small-scale output for three months. Four partial shipments of nickel-cobalt concentrate have been sent by boat to a Freeport refinery at Port Nickel, and shipments of nickel briquettes from Port Nickel have been made to Britain.

★

Nickel deposits in Northern Manitoba greater than those in the immediate Thompson area are in various stages of development, states Mr. J. C. Parlee, general manager of Inco's Manitoba division. The deposits at Thompson are being brought into production at a cost of $175,000,000. They lie in a belt 80 miles wide and 10 miles deep. Drilling and shaft sinking are being carried out on sites just west of this swath. When ore eventually is brought to the surface from the surrounding sites it will be brought to Thompson for refining.

LONDON METAL AND ORE PRICES, MARCH 10, 1960

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 0d. lb.
Cerium (99%) net, £16 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 14s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 250s. 1½d.
Iridium, £23/£25 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Manganese Metal (96%/98%) £275/£285
Magnesium, 2s. 2½d./2s. 3d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £22/£24 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28/28½
Quicksilver, £70½/£71 ex-warehouse
Rhodium, £45/£48 oz.
Ruthenium, £16/£18 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 79½d. f. oz. spot and 79½d. f'd
Tellurium, 21s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis		19s. 6d./21s. 6d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)		230s. per l. ton unit BeO
Bismuth		30% 5s. 0d. lb. c.i.f.
		20% 3s. 3d. lb. c.i.f.
Chrome Ore—		
Rhodesian Metallurgical (semifriable 48%)	(Ratio 3 : 1)	£15 15s. 0d. per ton c.i.f.
,, Hard Lumpy 45%	(Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
,, Refractory 40%		£11 0s. 0d. per ton c.i.f.
,, Smalls 44%	(Ratio 3 : 1)	£14 0s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) Nb_2O_5 : Ta_2O_5		175s. per l. ton unit c.i.f.
Fluorspar—		
Acid Grade, Flotated Material		£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)		156s. 0d. ex. works
Lithium Ore—		
Petalite min. 3½% Li_2O		40s. 0d./45s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O		40s. 0d./45s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O		£25 0s. per ton f.o.b. Beira
Magnesite, ground calcined		£28 0s./£30 0s. d/d
Magnesite Raw (ground)		£21 0s./£23 0s. d/d
Manganese Ore Indian—		
Europe (46%-48%) basis 67s. 6d. freight		73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)		69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)		nom.
Molybdenite (85%) basis		8s. 11d. per lb. (f.o.b.)
Titanium Ore—		
Rutile 95/97% TiO_2 (prompt delivery)		£28 0s. 0d. per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2		£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)		152s. 6d./157s. 6d. per unit c.i.f.
Vanadium—		
Fused oxide 95% V_2O_5		8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2		£16/£16 10s. ton c.i.f.

COMMON MARKET TARIFFS

The six European Common Market countries have signed an agreement setting up a joint external tariff system for imports of 70 products for which certain members wanted special protection (*vide* our last week's issue, p. 275). The new customs duties announced for the list "G" products include: aluminium 10 per cent, lead and zinc 0.6 U.S.c. a lb., lead and zinc ores exempt, lead and zinc scrap exempt, aluminium scrap exempt, and aluminium waste 5 per cent.

Tariff free quotas were fixed as follows: The Netherlands, 40,000 tons of lead and 10,000 tons of zinc—estimated to be equal to domestic consumption. Belgium, free importation of zinc and 20 per cent of lead requirements; Germany, 20 per cent of requirements of both lead and zinc.

FALL IN WOLFRAM PRICES

The undertone of the London wolfram market has lately been looking by no means assured, and the decline of prices in the past few days has occasioned little surprise. Dealers are currently suggesting a range of from 150s.-155s. per l.ton unit c.i.f. Europe, compared with 156s. to 161s. a week ago. The general level of demand is reported to be unimpressive.

The fall was apparently triggered off by rumours of a Russian sale of wolfram, which was said to have taken place at 5s. below the bottom of the then existing market range. All other details have remained obscure.

U.S. ALUMINIUM SOLD CHEAPER ABROAD

A group of independent aluminium fabricators in the U.S. recently complained that the "Big Three" aluminium producers were selling pig aluminium to European buyers for 22¼ c. per lb., plus a cent for insurance, and freight, compared with the U.S. selling price of 26 c. per lb. The Aluminium Extruders Council asserted that this "discriminatory price policy" endangered the independent extruders' business. Commenting on the Council's statement, executives of Reynolds Metals and Alcoa have pointed out that U.S. producers must sell overseas at prevailing prices.

MORE HOPEFUL FORECAST OF URANIUM DEMAND

In the most optimistic forecast which has been made for some time past, the Ontario Department of Economics has predicted that a resurgence of world demand for uranium is likely by 1966. This forecast is based on the proving of the natural uranium reactor for commercial power, the type which is being developed for Canada. It is the first official suggestion that no gap in demand will exist between 1966 and 1970,

the year in which most expert estimates see demand as being restored to balance with supply. Speaking in the House of Commons at Ottawa recently, Mr. Churchill, Canada's Trade Minister, said that the period 1966-1970 loomed as an awkward interlude in which it appeared there would be little or no sizeable market for uranium.

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U.S. domestic producers will have to absorb only about $15,000,000 of the reported $103,000,000 budget cut in Government uranium purchases, according to Mr. Gordon Weller, vice-president of the Uranium Institute. Mr. Weller expects domestic production to rise by another 400 tons in the fiscal year 1961 to 18,000 tons, at which level it will remain through fiscal 1962. Domestic deliveries are expected to reach their highest peak under the government programme in fiscal 1963, when they will exceed 18,500 tons.

MAGNESIUM GROUP MEETINGS

Time schedules for three major meetings of the Magnesium Association for 1960 have been announced. The Spring Technical Meeting has been scheduled for April 19-20 at Montgomery, Alabama. The annual meeting will be held in England and Germany from May 23-31, with sessions at London, Manchester and Hanover. This will be a joint meeting with the Magnesium Industry Council of Great Britain. Plant visits in England and Germany have been arranged. The annual convention is scheduled for Cleveland, October 17-18.

Speaking at the annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, Hazel B. Comstock, Bureau of Mines, U.S. Department of the Interior predicted that requirements for magnesium chloride (for the production of magnesium metal) and magnesium oxide (for making refractories) would increase greatly over the next few years, possibly doubling in less than two decades.

The magnesium industry, she stated, is making steady progress in developing new and improved alloys, some of which are now being used in rockets and missiles for temperatures reaching 700 deg. F. Continuing improvements in magnesium alloys and alloying techniques could be expected to result in wider use of magnesium for structural applications outside the defence industries. Moreover, magnesium's use as an alloying ingredient in the production of titanium and other metals could only mean that requirements would grow in proportion to the demand for these products. Finally, the demand from the steel industry for basic refractories was expected to rise from an estimated 563,000 tons for 1960 to 720,000 tons by 1970 and to a possible 810,000 tons by 1975.

★

A programme for the manufacture of magnesium and its compounds in Israel has been drawn up by a United Nations expert, who recommends further research to devise manufacturing methods suitable to local conditions at competitive costs. The expert believes that a cheap and efficient process can be developed in Israel to exploit the country's magnesium deposits, particularly the magnesium salts of the Dead Sea.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

There have been no untoward developments during the past week and what news there has been has exerted a mainly "bearish" influence on the market. As a result of this, and following the indications which were noticeable last week, values have inclined lower but at the same time a certain amount of buying support on the decline has limited the fall.

FACTORS INFLUENCING COPPER PRICES

In contrast to the upward tendency which has been established over recent months, world copper prices have been influenced primarily by discouraging reports from the U.S. Apart from the overall uncertainty created by the continued decline of Wall Street, consumers have been content to sit back in expectation that lower prices will be established before very long and in this connection a reduction in the customs smelter price from 35 c., established towards the end of last year, to 33 c., which is the current producers' price is regarded as imminent. Moreover, the smelter buying price for scrap has been further reduced during the week and is currently 24¼-24½ c., which is equivalent to an electrolytic price of 30-30½ c. for delivery three months forward. Dealer copper is also hanging fire with April material offered at 33 c. and May-June at 32 c. This compared to 38-40 c. at the peak of the shortage a few months ago resulting from the prolonged strikes. The Laurel Hill, New York, refinery of Phelps Dodge remains the only strike-bound property in the U.S. and the current series of meetings between the company and the Steelworkers' Union have been adjourned until the end of the week.

The London market has followed the general trend in spite of a greater than expected reduction of 535 tons in U.K. official warehouse stocks last week. These now stand at 3,072 tons which is more than 2,000 tons lower than at the beginning of the week and, so long as this situation persists, the low level of stocks must remain a sustaining influence on the market. Under present circumstances, it is hard to foresee any arrivals of copper in the near future to relieve the situation and the most likely source would appear to be on the part of U.K. consumers warehousing any surplus intake. Contrary to the recent trend, the backwardation has narrowed due, as in the reverse process, to daily technical considerations following the absence of any pronounced buying interest for cash and nearby dates.

TIN QUOTAS RAISED

The tin market has been subjected to some selling pressure, which it is suggested in some quarters originates from Buffer Pool sources and accounts for the rise of 930 tons in warehouse stocks last week. The results of the International Tin Council meeting were that the export quota for the next control period starting April 1 has been raised to 37,500 tons. This advance was unexpected by the trade, but, in fact, makes practically no difference to the existing situation, since during the present period, quotas have not been met in full by countries. For the next period the Council itself estimates that actual exports will only be about 35,000 tons.

The final draft of a new Tin Agreement to replace the current one, which expires on June 30, 1961, has been sent to U.N. for discussion at a Conference to be held in New York under U.N. auspices on May 23 next when the I.T.C. will also hold their next meeting. On Thursday the Eastern price was equivalent to £791⅞ per ton c.i.f. Europe.

LEAD/ZINC IN GOOD DEMAND

In the lead and zinc markets business has been very quiet and the main feature has been the sharp increase in the backwardation on zinc, whilst that on lead has been fully maintained at recent rates. In both cases this reflects the satisfactory level of demand, whilst supplies of nearby material are not burdensome although, in the case of lead, reports indicate cheap offers having been available on the Continent. In the U.S., lead demand has shown a small improvement whilst that for zinc is described as fair. Statistics issued during the week show that in February total U.S. zinc shipments exceeded domestic production and consequently stocks were again lower.

	February 1960	*January 1960*
Production ...	74,738	73,326
Total shipments ...	82,147	83,274
Stocks at end of month ...	137,062	144,471

Closing prices are as follows:

	March 3 *Buyers*	*Sellers*	March 10 *Buyers*	*Sellers*
COPPER				
Cash	£259¼	£260	£253	£253¼
Three months ..	£241	£241¼	£238	£238¼
Settlement ..	£260		£253½	
Week's turnover	11,200 tons		10,425 tons	
LEAD				
Current ½ month	£75⅜	£75⅝	£76	£76⅛
Three months ..	£74½	£74⅝	£75	£75⅛
Week's turnover	8,325 tons		6,550 tons	
TIN				
Cash	£784	£785	£785½	£786½
Three months ..	£784	£784½	£785	£786
Settlement ..	£785		£786½	
Week's turnover	755 tons		850 tons	
ZINC				
Current ½ month	£87⅞	£88	£88⅛	£88⅜
Three months ..	£87½	£87⅞	£87½	£87⅝
Week's turnover	2,475 tons		5,425 tons	

Mining Finance

High Speed at Western Deeps

The speed with which work was proceeding at Western Deeps has long made it apparent that some change might have to be made in the development schedule for the mine, and that new funds might have to be raised sooner than had been expected when shaft-sinking began.

This has now been officially recognized in a circular from the company convening an extraordinary meeting for March 31. The meeting will consider resolutions increasing the authorized number of £1 "B" shares from the nominal 1,000 to 13,000,000 and increasing the directors' borrowing power from £10,000,000 to £15,000,000.

It will be remembered that the plans for developing Western Deeps were divided into three stages. The first stage, which covered the sinking of two shaft systems and production of 80,000 tons per month from the V.C.R., was estimated to cost £21,100,000. As a result of the accelerated rate of sinking, of a new housing policy under which the company will buy its mine accommodation instead of leasing it, and of the transfer of some shaft-sinking work from stage 2 to stage 1, the first stage is now expected to cost £6,000,000 more than the estimate. Over and above the £10,600,000 already raised, therefore, Western Deeps will need another £14,500,000 to complete stage one. The method of raising this money is "under consideration".

Western Deeps' "B" shares will rank *pari passu* with the "A" shares in all respects, except that no dividends will be payable on them until at least 10s. has been paid by way of dividend on the "A" shares. Of the first 5,600,000 to be issued, half must be offered to "A" shareholders *pro rata* to their holdings, and the remainder to the members of the loan syndicate, both at the same price. In addition, the loan syndicate members will have the right to subscribe for a further 5,000,000 "B" shares at par at any time between the first issue of "B" shares and a date twelve months after the "A" and "B" shares rank *pari passu* for dividend purposes.

LORAINE STRIKES IT RICH

The sort of result that Loraine shareholders have patiently awaited was announced by Mr. B. L. Bernstein, the chairman, at Tuesday's annual meeting of the company. The result in question—one stretch of reef averaging 1,844 in.-dwt. and another averaging 1,099 in.-dwt., both with 100 per cent payability and high uranium values—was achieved close to the subcrop of two Upper Elsburg Bands 3,000 feet of borehole T.V.2. Another high value —1,184 in.-dwt.—was disclosed close to T.V.2 in the Lower Elsburg zone.

Other important disclosures were a stretch of 260 feet on one band giving 808 in.-dwt., and a similar stretch on another which averaged 579 in.-dwt. All these reef disclosures were 100 per cent payable, and had good uranium values in association with the gold.

On the subject of shaft-sinking progress Mr. Bernstein said that the No. 3 shaft, sited in the centre of the old Riebeeck property, had only about 175 feet to go to its final depth. At this rate, development from the shaft should begin in June, with the initial object of linking up with the 52 level haulage which had been driven from the Loraine section. The official hope is that a holing through will be made some time in June, and that stoping from this section will begin before the end of the year.

Although this news is highly satisfactory, it must be borne in mind that all the high values were achieved over comparatively small footages. Perhaps the most encouraging feature is that the enrichment followed a well-defined pattern, with values increasing as the raises approached the sub-outcrop. This augurs well for the consistency of the Elsburg reefs in general, a point about which there had been some disquiet.

GHANA MAIN'S GOOD VALUES IN DEPTH

At Monday's meeting of Ghana Main Reef, Mr. C. J. Burns, the chairman, brought up-to-date the picture of progress at the mine given in his circulated address. The erection of the single drum hoist in the sinking compartment of the Tuappim internal shaft, he said, is progressing satisfactorily, and is expected to be completed very shortly.

Meanwhile, development in the Tuappim section during the current financial year has exposed 520 feet of payable reef on levels 17, 18, and 19, at an average of 9.4 dwt. over 57.3 in. This, said Mr. Burns, was most satisfactory. Not only would it prove a valuable addition to ore reserves, but it was a sound indication that the reef was persisting in depth. Before the end of the year it is expected that part of the 20 level will be exposed.

In the Main shaft section, payable development during the current year had amounted to 165 feet averaging 11.1 dwt. over 43.9 in. In this section, the 18 level drive north and the 19 level drive north will be fully exposed by the end of the year.

Mr. Burns devoted a large part of his speech at the meeting to a discussion of the relationship between British interests in Ghana and the Ghanaian government, a subject to which we hope to revert in a later issue.

Extracts from Mr. Burns' speech appear on page 309.

ASHANTI'S ORE RESERVES

At first sight, the ore reserve declaration of Ashanti Goldfields at September 30 last appears somewhat disappointing. Although the tonnage is substantially higher —1,993,105 against 1,586,300—the grade has fallen from 19.03 dwt. to 17.24.

In fact, however, any deterioration in the situation is more apparent than real. Ashanti's reserves are made up of ore in three distinct sections: the medium grade

LONDON MARKET HIGHLIGHTS

Gold shares opened the week on an encouraging note. For one thing, Continental selling seemed to have petered out and this, coupled with some bullish press comment and a cheerful Johannesburg market, brought many plus signs back to Kaffir pride lists. Free State Geduld and Western Holdings, helped partly by hopes of good March half-yearly dividends each moved up 1s. 10½d. to the common price of 165s., while in the Finance group Anglo American crept up to 10 $\frac{1}{16}$.

But lowering clouds over Wall Street brought a general depression to the Stock Exchange on Tuesday and this spilled over into the Kaffir market. Both F.S.G. and Holdings came back to 163s. 9d. and despite news of good gold values on the Elsburg reef series encountered by the No. 52 level haulage, Loraine slipped from 34s. to 33s. 1½d.

Wednesday developed into one of the worst days on record in Gold shares. Not only was Wall Street still dull, but the Continental selling started up again. Worst of all, the eagerly awaited Anglo American O.F.S. dividends merely brought disappointment to many small investors in Johannesburg.

Although actual selling here was never very large, buyers were conspicuously absent and virtually every share was severely marked down in price. Among the worst affected were Free State Geduld, finally 7s. 6d. down at 156s. 3d. after having been only 153s. 9d., and Western Holdings which slumped 8s. 1½d. to 155s. 7½d. Heavily hit in the Finance group were Anglo American Corporation which lost $\frac{7}{16}$ to 9½; not so many weeks ago they had been up to 11$\frac{5}{8}$.

De Beers, always susceptible to the mood of Wall Street, tumbled to 180s.; after hours came the final dividend of 7s. 6d. to make 12s. 6d. on the 5s. Deferred shares, a payment which just about fitted in with market expectations.

Coppers showed signs of resistance. Admittedly share prices eased back, but there was comparatively little selling and this was not surprising in view of the imminence of the interims—confidently expected to be increased—from Rhokana and Rhodesian Anglo American. Chartered, however, were a persistently dull spot and drifted to only 98s. 6d. following some Continental offerings.

M.T.D. (Mangula) were comparatively steady at 11s. 4½d. They had previously been a firm market in anticipation of Wednesday's meeting in Salisbury; the firmness seemed justified when the report of this meeting mentioned the possibility of a hitherto unknown orebody underlying the present one. (Statement p. 308).

Tins, being largely insulated from Wall Street, kept up reasonably well in the general circumstances. This was not surprising in view of the fact that the mines are now earning good profits and can be expected to do even better now that the Tin Council has again raised permitted mine export quotas.

Ayeinm and Justice mines and the high-grade Ashanti mine. Normally, development is so balanced between these three ore sources that the major part of any increase in reserves comes from the Ashanti mine.

During the last financial year, however, a hoisting breakdown at the Eaton-Turner shaft, which serves the lower levels of the Ashanti mine, meant that development footage in the area was severely restricted for some 5½ months. This in turn entailed the transfer of development effort elsewhere, with the net result that the great bulk of the increase in reserve tonnage came from Ayeinm where the grade is less than 11½ dwt. The proportion of Ayeinm ore in the reserves increased from 12 to 27 per cent, but this is a situation that will gradually right itself now that normal operations have been resumed at the Eaton-Turner shaft.

Plans for the current year are for a mill tonnage of 35,000 per month and a recovery of not less than 28,500 oz. It may well be that this rate will be exceeded. With costs remaining fairly steady, it seems clear that there should be room for a further improvement in the present 2s. dividend rate during the current year.

BUMPER RESULT FROM DE BEERS

The preliminary profit statement from De Beers Consolidated for 1959 shows that the company's earnings rose from £9,654,000 in 1958 to £12,432,000, in spite of an increase in the amount provided for taxation from £690,000 to £1,550,000.

From this, De Beers has declared a final dividend of 7s. 6d., 1s. 6d. higher than the corresponding payment last year. Added to the interim of 5s., this makes a total of 12s. 6d. against 10s. This is a little lower than some of the more optimistic forecasts, but is nevertheless highly satisfactory.

Behind this bumper result lies several factors, of which the most important was the record level of diamond sales in 1959. Including both gems and industrial stones, the total value of sales through the Central Selling Organisation in 1959 was over £91,000,000, more than £14,000,000 higher than in the previous record year of 1957.

MORE ABOUT BAMANGWATO CONCESSIONS

Further details of Bamangwato Concessions, the exploration company set up by the R.S.T. group to prospect parts of Bechuanaland, have become public as a result of a written reply by the Minister of State, Foreign Office, to a question asked by Mr. Creech Jones.

Mr. C. J. M. Alport, the Minister of State, said that the company will pay the Bamangwato tribe £3,000 per annum and the Protectorate Government £2,000 per annum during the 10-year currency of the exclusive prospecting agreement. If any discovery of importance is made, Bamangwato Concessions will be able to exercise mining rights for a period of 99 years. Mr. Alport added that the concession included a provision to the effect that the company will, so far as possible, train, employ, and provide opportunities for members of the Bamangwato.

BAD QUARTER FOR BURMA MINES

The fall in output forecast in the September quarterly report of Burma Corporation, the jointly owned subsidiary of Burma Mines and the Burma government, has not proved so severe as had been thought in some quarters. Nevertheless, the effect on profits was marked. Ore extraction fell from 32,495 tons in the September quarter to 25,256 tons in the December quarter. This had the effect of reducing gross operating profits from K.22,95,300 to K.5,63,600.

Unfortunately, this decline is not yet over. The cause was a series of ground movements which, though not interrupting production themselves, necessitated the transfer of badly-needed skilled labour to rehabilitation and safety work. Only now is production recovering, so that the results for the March quarter will probably be little better than those reported for the December 31.

Burma Mines' statement appears in the next column.

SPRING O.F.S. DIVIDENDS

Unlike many of the South African mines, the companies of the Anglo American group tend to view their distribution policy on an interim and final basis. The fact that four of the five mines concerned are paying less than in September last is, therefore, no great cause for concern. The real standard for comparison is the distribution rate of the last twelve months as against that of the preceding year, and by this yardstick the latest payments are by no means unsatisfactory. The richest of these mines—Free State Geduld, President Brand and Western Holdings—are all paying more than in 1958-9. Of the other two, Welkom is continuing the 3d. rate that must be regarded as a maximum until its debentures have been fully repaid, while the reduction of 3d. in the Steyn payment was by no means unexpected in view of the heavy rate of capital spending at this property.

The latest dividends are summarized below, together with the payments of the preceding eighteen months for comparison.

Company	*Sept.* 1958	*Mar.* 1959	*Sept.* 1959	*Mar.* 1960
	s. d.	s. d.	s. d.	s. d.
F. S. Geduld	3 0	3 6	4 6	3 6
P. Brand	2 6	2 6	3 0	2 6
P. Steyn	1 3	1 3	1 3	1 0
W. Holdings	4 0	3 6	5 0	4 0
Welkom	3	3	3	3

Metalsulcis Capital Increase.—Miniere Metallifere Sulcitane, known as Metalsulcis, has converted its 1,000,000 lire capital into bearer shares. The capital has simultaneously been raised to 400,000,000 lire.

Accident at Simmer and Jack.—Following an earth tremor in the area of the Simmer and Jack gold mine, a fall of rock occurred in the South Deep shaft of the property. Eight mineworkers lost their lives. Blasting operations have been suspended in this section of the mine, but work is proceeding normally elsewhere.

Petaling Results.—The available balance from operations of Petaling Tin in the year to October 31 last amounted to £80,955 compared with £24,493 in the preceding year. Dividends were resumed with two payments totalling 20 per cent. This improvement was largely due to the better price received for the company's output—£481 per ton of tin ore against £433 per ton in 1957-8. In his advance statement, the chairman, Mr. D. C. Thomson, says that prospects for the coming year are still more encouraging. No. 6 dredge will be operating in virgin ground, and the easing of quota restrictions will enable it to work more economically than has been the case in the past two years. Meeting, March 18.

More Capital from Govt. G.M.A. and New State Areas.—The boards of Government Gold Mining Areas and New State Areas have declared further capital repayments for each company. That from Government G.M.A. is of 6d. per share, leaving a balance of 2s. 6d. on the present nominal value, and New State Areas is to repay 3d., leaving 1s. 9d. Both payments become due on March 16.

The Proprietors of British Patent No. 685,445 for "APPARATUS FOR CONTINUOUSLY DIGGING COAL", desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 - 58 Lincoln's Inn Fields, London, W.C.2.

BURMA MINES LIMITED

reports that the operations of

BURMA CORPORATION (1951) LIMITED

for the Quarter ended December 31, 1959, resulted in an estimated Net Profit of K.1,61,100 (£12,082) compared with K.6,82,900 (£51,218) in the previous Quarter.

Details of Revenue, Expenditure, Ore Extraction and Production may be obtained from Central Registration Limited, 9 Basinghall Street, London E.C.2, upon application.

Additionally the Board of Burma Corporation (1951) Limited states:

"The estimated results for the Quarter under review are disappointing as compared with the previous Quarter but are attributable to the lower quantities of lead, silver and zinc concentrates available for sale and to a fall in the quantities, and consequently values of metals on hand at the end of the Quarter as compared with September 30, 1959.

"Reference was made in the Report for the Quarter ended September 30, 1959, to the fall in production of ore from the Mine during November and December and that the full effect of this decline would be reflected in the results for the Quarter ending March 1960. To some extent however the effects of this decline in ore extraction have become apparent in the Quarter under review.

"The decline in ore extraction mentioned above is attributed mainly to the very heavy repairs necessitated owing to technical and physical difficulties encountered by a succession of ground movements in several sections, an inseparable hazard of mining, which required an unusually high proportion of skilled labour to concentrate temporarily on unproductive but essential repairs and rehabilitation for future production as a result of which mine output is now steadily recovering."

THE CHARTERED BANK

CONTINUED EXPANSION AND HIGH LIQUIDITY

IMPORTANCE OF RAISING ASIAN LIVING STANDARDS

MR. V. A. GRANTHAM'S STATEMENT

The One Hundred and Sixth Annual General Meeting of The Chartered Bank will be held on March 30 at 38, Bishopsgate, London, E.C.2.

The following is an extract from the statement by the Chairman, **Mr. V. A. Grantham,** which has been circulated with the report and accounts for the year 1959 :

The Bank's Balance Sheet

The accounts indicate the continued expansion of the Bank's business and reveal a high degree of liquidity. The total of our own balance sheet at £270,390,101 is the highest we have ever recorded being £27,271,915 up on last year's figure which was itself a record.

Our Consolidated Balance Sheet shows a total of £317,021,709, which is £31,591,207 up on that of last year.

Consolidated Profit and Loss Account

The net profits for the year at £1,014,696 are higher by £21,106 than last year, in spite of continually increasing working costs in all parts of the world, and may be considered very satisfactory.

We paid an interim dividend in September last of 7½%, less income tax, absorbing £229,688 and it is now proposed that out of the balance available a final dividend of 7½% less income tax be paid, costing £229,687. We have repeated the allocations made last year of £250,000 to Bank Premises and Furniture and £125,000 and £20,000 respectively to the Pension Fund and Widows' and Orphans' Fund. £150,000 has been transferred to Reserves for Contingencies and the increased balance carried forward is £491,994.

The Irano British Bank

Our joint venture in Iran has now completed its first working year and I am pleased to report that good and steady progress has been made, and this is reflected in the figures of the first balance sheet. These good results have been achieved mainly through the industry and application of the staff, both European and Persian, and it is particularly gratifying to find a feeling of loyalty amongst the bank's national employees and the promise that many of them will, with more training, be able to fill key positions in the expanding organisation.

This expansion so far has led, in addition to the head office in Tehran and the original branch in Khorramshahr, to the opening of a bazaar branch in Tehran and a branch at Abadan. A further branch is shortly to be opened at Ahwaz. All this has been achieved in the face of a general shortage of local funds, increasing competition from new banks and perhaps a less helpful officialdom than we were led to expect.

Outwardly at least the country gives an impression of stability although the Bank Melli is having to take steps to conserve foreign exchange. Without being critical of the present arrangements, I believe that it would facilitate trade and be in the country's interests were the Bank Melli to deal freely in foreign exchange, both ready and forward, with the commercial banks at special rates in a manner similar to the operations of central banks in other countries.

The great need is, of course, for exports in addition to oil.

Oversea Survey

As a bank primarily engaged in financing oversea trade we were vitally interested in the findings of the Radcliffe Committee, for in 1957 when it was appointed, there was widespread anxiety that internal inflation might jeopardise the hard won progress which had been made in rehabilitating and modernising British industry and there was considerable doubt, both at home and abroad, whether it would prove possible to maintain sufficient confidence in sterling to assure its status as a major international medium of exchange.

In the light of the steps taken by the government in the interim to deal effectively with both those problems it is interesting to note that the report, which was published in August, gives tacit approval to the working of the monetary system and I hope we shall hear no more from the politicians and economists who would restrict the use of sterling in international trade. The Chartered, and all other British banks trading overseas, welcome the continuance of conditions which allow us to handle worldwide trade and to contribute thereby to the United Kingdom's invisible earnings.

Last year I mentioned the European Economic Community and the fears that existed in Asian countries that any addition to the six countries of E.E.C. might mean surrounding Europe with tariff barriers. There was in fact no such addition but in any case fears were, to some extent, allayed by figures produced at the recent meeting of G.A.T.T. in Tokyo showing increased trade between the E.E.C. area, and in particular the undeveloped countries. This helps to confirm my own views that an integrated free trade area for the whole of Europe must ultimately result in an expansion of the trade of the Asian countries in which this Bank has branches, and I trust that Her Majesty's ministers and officials will, in the not too distant future, see a successful outcome to the patient and difficult negotiations in which they have played such a prominent part.

Iraq

There were signs during 1959 of a gradual return to more normal business conditions. This was helped by a rise in oil exports, which totalled thirty-nine million tons. This was unfortunately offset to some extent by poor harvests and it was necessary for the government to prohibit the export of barley and to arrange for the import of fairly large quantities of wheat.

Import policy was liberalised in the second half of the year but the resultant improvement in business conditions was offset by the steep rise in overhead charges. The country is still in a state of transition and it is too early yet to say how the new pattern of trade relations will work out. It is clear however that, given peaceful conditions, the country will go forward with its development schemes and will for many years be a buyer of both capital and consumer goods.

India

Thanks to generous assistance from abroad the shortage of foreign exchange which threatened to retard India's development last year was overcome, and it appears that most of the production targets will be reached in the second five-year-plan which is approaching its final year. India is now at the stage when it should begin to reap the benefit of the vast expenditure which has been made under the two five-year plans although there has been criticism, much of it well founded, of the various priorities under the plans and also of the methods by which they have been financed. This criticism however should not be allowed to obscure or minimise the very real progress which has been made in many sectors of the national economy. The completion of the three new steel plants and the expansion of the two existing ones should assist in the further development of the many lighter industries in the private sector, which have been established during the last few years and are now going into full production. In order to finance this development on a national scale it has been necessary to resort to the potentially inflationary expedient of deficit financing, and it says much for the manner in which the Indian authorities handled the country's internal finances that there has been no major inflation. In fact, the price level has risen less in recent years than in many highly industrialised countries with stronger economies than India's.

In the banking field the expansion in deposits, to which I referred last year, has continued and the liquidity of the banking system has increased. There would seem little point, therefore, in the prevalent practice of quoting high deposit rates in order to attract funds for which profitable employment is lacking. It was reassuring to have an official government statement in the Lok Sabha that the Planning Commission had come to the conclusion that the nationalisation of banks was not a desirable step.

Pakistan

A year ago it seemed that the situation in Pakistan was rather more hopeful than for some years past and in the event the country has made satisfactory progress during 1959. In recent years governmental instability and lack of leadership have cost Pakistan dear, and for this reason the population has responded well to the military regime which at present controls its affairs. Stern measures were required to eradicate the corruption and inefficiency which had previously been such a feature of the country's administration and it is to the credit of the present regime that, although it had dictatorial powers, it has used them with moderation and with justice.

More settled conditions have been reflected in a noticeable improvement in Pakistan's trading and payments position and the augmented foreign exchange holdings have permitted a more liberal import programme, which will be of benefit to the country's new manufacturing industries.

It is encouraging that the government has effected an improvement in the agricultural sector of the economy in the relatively short time since it assumed power and, once again, Pakistan's prospects for the coming year appear reasonably favourable, particularly if the improved relations with India lead to a settlement of some of the outstanding disputes between the two countries.

Singapore

The first elections under Signapore's new constitution were held last May and the new government, which was voted into office by an overwhelming majority, has acted soundly and responsibly. Great care has been taken to avoid any official action which might have effects prejudicial to trade and industry, and in particular to the island state's traditional entrepot business. The government clearly recognises that the living standards of the expanding population can only be assured and improved if the national income grows at the same rate and conditions in Singapore remain attractive to capital and enterprise from abroad. By the imposition of strict economies the gap between revenue and expenditure has been bridged and the current financial position of the state appears sound.

Singapore's prosperity is likely to be based for a very long time to come on trade and it is, therefore, satisfactory that last year trade turnover increased. This was largely because of the high prices of rubber and tin and the increased export quotas of the latter commodity.

Hong Kong

Very little complaint, if any, has been heard from any section of Hong Kong's industry about business conditions in 1959 and some of the major industries are at present enjoying boom conditions. During the year the value of total exports showed a ten per cent rise, nearly all of which is accounted for by increased shipments to the United States, and it was particularly fortunate that the restriction of textile exports to the United Kingdom has been more than counterbalanced by expanding markets e sewhere. Despite this general picture of prosperity it cannot be said that 1960 opens too propitiously for the Colony, for the increasing tendency for countries to apply trading restrictions against Hong Kong's products is disconcerting, especially as Hong Kong is now heavily dependent upon the marketing of its manufactured goods to sustain its economy and avoid large scale unemployment. Private building continued apace last year both in Hong Kong and Kowloon and there are still no signs of a slackening of activity in this direction. Even to the frequent visitor the rapidity with which the skyline changes is a thing to be wondered at, and perhaps nothing has done this more effectively than the completion of our own eighteen storeyed building, which is universally acclaimed as both imposing and attractive. Our next venture in this line is to be a new branch in Kowloon, which we expect to open towards the end of 1960.

West End, London

Last autumn our branch in the West End of London was transferred to more modern and conveniently situated premises at 2 Regent Street. The design and décor of the new office have been commended in the technical press and a coloured illustration of a section of the public space appears in this report.

Conclusion

The importance of raising Asian living standards is now generally accepted and the highly industrialised nations have recognised that they have a responsibility for assisting in the process. This assistance will, for the most part, be in some form of aid, either direct from country to country or through one of the international funds. Those exporting the capital or making the grants, and the United Kingdom is one of the countries likely to be increasingly involved, will want to be sure that their contributions are genuinely devoted to the development of the receiving country and the benefit of its people. The tremendous national pride of the young countries will not allow them to accept aid with terms attached and yet, as some of these countries are run today, aid will not put them on their feet and give them viable economies.

The problem then is to find a formula which gives to these countries, with their consent, a control-free administration which would eliminate opportunities for bribery and corruption and a unit of currency having the same internal and external value, thus eliminating the rewards of smuggling and the other forms of currency evasion which run down the country's external assets — possibly in far greater sums than the aid received.

It is not uncommon these days for leaders of new nations to state that democracy does not work with them but what is not said is that their inexperienced politicians and civil servants often find it beyond their powers to run restricted and controlled economies. Cannot, therefore, those advisers of the World Bank and the International Monetary Fund, and those negotiating direct loans with these countries, advocate with more persuasiveness the freeing of rates of exchange, the concentration of trade in private hands, with the elimination of that increasing economic menace, state trading, and the ceasing of discrimination against the nationals and the trading of those highly-taxed countries whose peoples are bearing the cost of the aid ?

Book Reviews

Asbestos. Its origin, Production and Utilization, by W. E. Sinclair. Second edition. Produced by Mining Publications, Ltd., 482 Salisbury House, London Wall, London, E.C.2 .pp. 512. Price 60s.

This new edition of Sinclair's "Asbestos", a book generally welcomed when it first appeared in 1955, has been made even more comprehensive. Several new chapters dealing with primary production and the manufacture of asbestos products in North America, a field recently visited by the author, have been added. Besides a geological appraisal of the future potential in that area, details are given of actual mining and milling at the various producing centres, while the latest fabrication techniques are fully described. This aspect of the asbestos picture has been brought up to date in respect of all the main world producing and manufacturing fields. The relevant statistics covering production, distribution, marketing, and prices are included, and there are a number of charts giving details which date from the earliest and cover the latest records.

The basic chapters dealing with the origin of the asbestos minerals and the record of recovery, from source to final uses, have been revised, with the description of many new discoveries and particulars of recent developments in various branches of the industry.

Presenting, as it does, a detailed and authoritative picture of the several varieties of asbestos and their spheres of usefulness, this book should be of interest not only to practising engineers and executives but to students and others connected directly or indirectly with the industry.

New Bureau of Mines Minerals Yearbook. The latest Bureau of Mines' Minerals Yearbook, a comprehensive three-volume record of activities and developments in the National's mineral industries during 1958, has just been published, by the Department of the Interior. This 2,779-page edition is the first since 1941 to be completed in the year immediately following that covered. Its publication is the culmination of an intensive Bureau programme, designed to overcome a yearbook backlog that resulted because of urgent assignments during World War II and the Korean emergency.

An essential reference work for scientists, statesmen, and businessmen, as well as educators and students, the 1958 yearbook contains a wealth of facts on mineral production, uses, distribution, imports and exports, employment and injuries. Its three volumes are: Volume I—Metals and Non-metals; Volume II—Fuels; and Volume III—Area Reports (a detailed review of mineral activities in the 50 States and also the offshore areas of the United States). In addition, each volume includes summaries of important statistical information, discussions of significant technological developments, detailed statistics on world mineral production, and accounts of outstanding industrial developments both at home and abroad.

Copies of the 1958 Minerals Yearbook can be obtained ONLY from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at the following prices: Volume I—Metals and Minerals, Except Fuels, $4; Volume II—Fuels, $2.25; Volume III—Area Reports, $3.75. Individual chapters comprising each volume also are available separately from the Superintendent of Documents at prices ranging from 5 c. to 35 c. The Minerals Yearbook is not sold by the Bureau of Mines.

The Lead Storage Battery, by H. G. Brown, 4th edition, published by John Sherratt & Son, 161 pp. including many places and diagrams, price £1 4s. This fourth edition covers all aspects of the subject, from the chemistry of the lead-acid cell and formation and structure of plates, through to the various types of batteries for differing purposes and special duties, care, maintenance, etc.

M.T.D. (MANGULA) LTD.

(Incorporated in Southern Rhodesia)

A SATISFACTORY YEAR
PLANNED RATE OF PRODUCTION ATTAINED
COMMANDER H. F. P. GRENFELL ON NEAR AND LONG TERM PROSPECTS

The thirteenth Annual General Meeting of stockholders of M.T.D. (Mangula) Limited was held on March 9 in Salisbury, Southern Rhodesia.

Commander H. F. P. Grenfell, D.S.C., R.N. (Ret'd) (the Chairman), presided and, in the course of his speech, said:—

The most important feature of the year was the installation of the second Aerofall Mill unit, as this enabled us to raise production to our planned rate of 3,000 short tons of ore per day.

The new mill was commissioned in April but full production was not reached until July, so that the accounts before you only include the last three months of the year at the higher output. Nevertheless the net profit for the year was £394,224, as compared with £3,740 the year before. Out of this a maiden dividend of 5 per cent—£225,000—was declared in November. I think you will agree that this was a satisfactory result for the second year's operations.

At September 30, 1959, there was still a large sum outstanding on Loan Account with the Parent Company, and your Directors decided to raise funds to discharge this indebtedness by offering to Members the 2,000,000 shares held in reserve at 9s. 6d. per share in the proportion of one new share for every nine stock units held. The offer was subscribed to the extent of 99.31 per cent.

As a result, the Parent Company's loan has now been entirely repaid, and a saving in interest charges of nearly £70,000 a year, has been achieved.

The Year's Operations

Turning now to the Report by the Consulting Engineers—a summary of which is given with the Accounts—you will see that the tonnage milled was 736,400 short tons of ore, and that 16,384 short tons of concentrates containing 7,486 long tons of copper were produced.

With the higher output, operating costs fell from 27s. 8d. to 25s. 3d. per short ton of ore treated, and now that full production has been reached, a further substantial reduction can be expected.

Credit is due to Mr. Wilson and all his staff and employees for these results. A measure of their efficiency is indicated by the fact that productivity per employee was nearly double that of last year.

Ore Reserves

You will no doubt have noted that after allowing for the year's production, the total of ore reserves, which covers the Molly Section only, shows a reduction of some 500,000 tons as compared with last year. We have deliberately made this reduction as a precautionary measure pending further clarification by development, of certain ore zones where diamond drilling has shown the general structure to be particularly complicated.

As we progress the geological picture will become clearer and we shall be able to determine with much greater accuracy the position and shape of the ore bodies and hence the extent of the ore reserves.

For example it now looks as if we may have to modify our original conception of a series of tabular ore bodies in favour of an elongated layer of ore of irregular thickness and shape, with the possibility of a second layer lying below the main layer and following its contours.

Recent drilling results on the lower levels where we have made a number of entirely new intersections of ore, the best of which assayed 2.49 per cent copper over a width of 53 feet, support this theory of a second and hitherto unknown layer.

However, the picture is still far from clear, and although I am optimistic as to the results of further exploration on the lower levels, I am sure it is wise to await these results before coming to any definite conclusions.

Development is also continuing in the Norah area. In the vicinity of the Brian Shaft some 230,000 tons of sulphide ore of better than average grade have already been proved, and production on a small scale is planned concurrently with further exploration.

Last year I mentioned the likelihood of discovering further ore bodies of a similar nature to the north of the Brian Shaft. It now appears that there is a possibility of at least 1,000,000 tons of ore of economic grade in this area, and the Harry Shaft is being sunk for the purpose of carrying out further development and underground drilling.

In addition to this work we are busy reclaiming one of the old shafts at the Silverside workings, 13½ miles to the south-east of the Molly Section, with a view to a re-examination of this prospect, and are also actively engaged in geochemical and geophysical exploration of various other parts of the property.

Mangula has now been officially gazetted as a township and once the roads are tarred, work on which will begin as soon as the rains are over, I believe it will develop into a model settlement where people can live and work under the happiest conditions.

The Outlook

As to the future, I am no crystal gazer, but I cannot help feeling that the near-term prospects for our industry are reasonably good. The prolonged strikes of the past year have surely reduced supplies in the pipelines to a low level which it will take some time to restore to normal. Business in the United States has resumed its upward trend and the demand for copper should grow with it.

It is true that at present there is an excess of productive capacity, but it seems to me that this is only a temporary state of affairs, and that in the long run, nothing can stop the consumption of copper rising with the demands of an increasing world population whose standard of living is improving year by year.

For these reasons, I take an optimistic view of the long-term prospects of the copper industry and therefore of your Company's future, while I have little doubt—barring unforeseen circumstances—that our results for the current year will be a good deal better than those presented to you today.

The report and accounts were adopted.

FALCON MINES

MR. F. L. WIGLEY'S STATEMENT

The fiftieth annual general meeting of Falcon Mines Limited will be held on March 31 in Bulawayo.

The following is an extract from the Statement of the Chairman **Mr. F. L. Wigley,** circulated with the report and accounts for the year ended September 30, 1959:

The reasons which prompted your Board's decision to increase the Issued Capital by a further 181,561 shares of 5s. 0d. each are fully stated in the Circular to Members dated 4th February, 1960, and I need only add that it will be an advantage to have funds available for accelerating an exploratory development programme as initial results may justify.

The Net Profit for the year was £151,236. The sum of £75,929 has been appropriated for expenditure on Fixed Assets and Mine Stores. After providing for Dividends Nos. 11 and 12 totalling 10¼d. per share (17½ per cent), which absorbed £79,433, and bringing to account an over-provision for taxation in previous years of £971, there remained a balance unappropriated of £9,446 compared with £12,601 brought forward from last year.

At the Dalny Mine, I am pleased to report that the fresh series of metallurgical tests referred to in my Review last year resulted in a most satisfactory improvement in gold extraction. Total residues for the year averaged 0.72 dwts. per ton but the average for the last six months of the year was only 0.59 dwts. and there has been a further reduction during the current year.

Working costs were reduced by 6d. per ton milled compared with the previous year in spite of a substantial increase in development expenditure. The proposal to raise the electricity tariff by 15% was successfully opposed by the Southern Rhodesia Mining Industry and a revision to an increase of 5%, pending a further investigation into the whole tariff structure, was obtained. The higher charges came into effect in February, 1960.

The estimated ore reserve at September 30, 1959, was 672,000 tons valued at 4.90 dwts. per ton over a width of 107 inches.

On the Pixy section a shaft was sunk to a depth of 380 feet and a level (No. 4) was established. A crosscut from the shaft intersected the reef in the vicinity of the No. 2 borehole mentioned in last year's Review and driving had exposed 105 feet of payable reef by the end of the year. Since the close of the year work on this level has continued to yield encouraging results and, in addition, the drive of the Pixy reef commenced from the Dalny 7 level crosscut has intersected values at this lower horizon in the shaft area. Work is now in hand to effect a holing between this level and 5 level to which the Pixy shaft was sunk during January and February, 1960.

At the western end of the strike, the dewatering and reclamation of old shafts in the Arlandzer area has reached the stage where development in fresh rock below the oxide zone worked in former years can commence.

The Tribute Agreement over the M'tuga Copper Claims was extended to August 31, 1960. Royalties totalling £13,276 were received from the Tributors during the year.

Rand and Orange Free State Returns for February

GOLD OUTPUT AND PROFIT

Company	February 1960 Tons (000)	Yield (oz.)	Profit† (£000)	Year ends	Current Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)	Last Financial Year Total to date Tons (000)	Yield (oz.)	Profit† (£000)
Gold Fields										
Doornfontein	94	38,413	189·2	J	757	307,798	1523·9	700	291,348	1505·4
Libanon	112	26,647	64·7	J	887	208,712	499·3	782	184,750	429·8
Luipaards Vlei	65	11,428	4·7	J	560	100,610	43·1	557	96,814	43·0
Rietfontein	16	4,202	6·8	D	32	8,447	14·4	32	8,600	16·7
Robinson	44	8,940	L7·0	D	94	18,577	L20·2	130	26,972	L42·2
Simmer & Jack	79	13,123	L19·1	D	156	26,963	L38·7	174	33,991	18·2
Sub Nigel	64	15,030	16·2	J	524	123,968	154·1	527	126,956	195·4
Venterspost	124	31,403	63·9	J	1,008	254,939	494·0	1,017	253,926	464·5
Vlakfontein	50	17,989	84·6	D	101	36,209	170·7	98	35,315	166·2
Vogels	86	18,284	20·3	D	174	37,214	44·0	180	41,180	83·8
West Drie	118	108,514	953·7	J	858	785,687	6668·7	648	617,359	5044·8
Anglo American										
Brakpan	134	16,474	7·1	D	276	33,742	20·5	266	31,694	16·2
Daggas	231	46,457	228·0	D	461	92,808	455·6	457	93,461	484·2
East Daggas	104	17,441	39·3	D	206	34,731	77·8	183	30,465	53·2
F. S. Geduld	94	81,076	658·4	S	470	401,594	3230·4	369	277,332	2023·8
President Brand	115	93,276	826·3	S	577	473,249	4188·4	480	362,296	3104·7
President Steyn	100	38,805	175·2	S	509	200,641	948·2	458	179,019	913·4
S. A. Lands	94	19,615	41·4	D	187	39,005	82·8	180	37,835	107·7
Springs	104	14,406	15·1	D	209	28,820	30·5	203	27,960	18·2
Vaal Reefs	94	42,300	226·2	D	188	84,600	453·1	156	70,986	395·1
Welkom	98	30,963	78·1	S	487	153,538	380·6	450	136,631	382·5
Western Holdings	148	98,790	829·5	S	709	465,811	3826·8	496	293,417	2225·7
West. Reefs. Ex.	135	37,935	127·8	D	269	75,595	257·1	220	56,781	152·2
Central Mining										
Blyvoor	124	81,322	620·0	J	1,022	670,025	5089·2	839	551,155	3997·6
City Deep	109	22,983	5·1	D	218	45,880	12·2	224	46,812	21·2
Cons. M.R.	73	14,158	6·2	J	715	135,201	57·5	1,107	161,144	115·1
Crown	196	32,698	8·2	D	409	67,762	20·3	435	68,112	16·1
D. Roodepoort	179	32,932	46·3	D	375	68,512	98·9	365	66,926	103·4
East Rand Prop.	206	53,706	90·3	D	424	109,185	185·5	424	109,169	228·7
Harmony	142	57,019	249·6	J	1,135	452,019	2013·5	798	320,310	1253·9
Modder East	131	12,710	L2·2	J	1,080	105,854	10·4	1,068	105,231	16·9
Rose Deep	26	4,406	1·2	D	53	8,870	1·8	74	10,829	L0·4
J.C.I.*										
Freddies Cons.	58	13,385	L42·0	D	117	26,664	L81·0	110	27,348	L70·3
Govt. G.M.A.	51	10,350	0·5	D	105	21,206	1·1	115	21,260	L14·0
Randfontein	22	4,089	3·1	D	47	8,806	6·3	57	9,481	14·2
Union Corporation										
East Geduld	128	37,760	242·3	D	262	77,431	504·4	260	79,964	544·1
Geduld Prop.	72	13,143	25·0	D	147	27,092	57·5	138	25,125	26·3
Grootvlei	210	43,891	223·9	D	425	88,833	457·4	395	83,836	415·4
Marievale	96	23,616	121·3	D	195	47,797	246·3	173	44,036	208·0
St. Helena	155	51,928	322·4	D	310	103,078	635·2	275	81,248	426·9
Van Dyk	70	11,886	9·3	D	139	23,921	22·6	149	28,089	50·1
Winkelhaak	79	24,214	103·2	D	159	48,615	204·5	137	31,491	36·3
General Mining										
Buffelsfontein	143	56,188	301·0	J	1,155	445,093	2352·7	969	328,225	1503·0
Ellaton	28	6,652	26·7	D	57	13,542	54·2	60	14,170	60·2
S. Roodepoort	29	6,931	22·1	J	239	57,042	182·2	238	56,472	189·5
Stilfontein	147	66,150	332·7	D	307	138,230	736·7	252	128,645	835·7
W. Rand Cons.	124	17,549	7·1	D	251	35,514	13·8	249	36,180	28·6
Anglo Transvaal										
Hartebeestfontein	100	47,250	272·3	J	777	390,145	2413·6	692	37,867	2550·2
Loraine	76	16,150	L15·8	S	391	80,201	L90·8	371	72,431	L92·8
N. Klerksdorp	11	1,170	L6·2	D	22	2,447	L11·6	19	2,048	L16·5
Rand Leases	179	27,298	23·7	J	1,487	222,120	190·5	1,444	210,709	101·6
Village M.R.	32	4,910	1·5	J	342	37,376	5·6	216	38,085	6·8
Virginia O.F.S.	134	30,284	24·5	J	1,067	243,811	149·2	894	231,983	304·1
Others										
N. Kleinfontein	74	9,701	0·1	D	157	19,824	0·2	162	21,171	6·0
Wit Nigel	18	4,288	5·0	J	137	34,865	40·8	142	34,440	48·2

Gold has been valued at 249s. 10d. per oz. fine (January 250s. 4d.). L indicates loss. † Working Profit. * Working Profit includes sundry revenue. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Luipaards Vlei, Randfontein and W. Rand Consolidated.

ESTIMATED URANIUM REVENUE

Company	Year ends	Feb. Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)	Company	Year ends	Feb. Profit (£000)	This year (cum.) (£000)	Last year (cum.) (£000)
Goldfields					**J.C.I.**				
Doornfontein	J	16·0	119·0	119·0	E. Champ d'Or (*b*)	D	7·0*	14·1*	12·8*
Luipaards Vlei (*a*)	J	94·0	746·0	718·0	Freddies Cons.	D	30·0*	62·0*	64·0*
Vogels	D	55·0	110·0	100·0	Govt. G.M.A.	D	23·1*	46·2*	44·1*
West Drie	J	50·0	400·0	368·0	Randfontein (*a*)	D	110·0*	220·0*	216·4*
Anglo American					**General Mining**				
Daggafontein	D	140·2	279·6	285·2	Buffelsfontein	J	210·0	1694·0	1582·0
P. Brand	S	47·9	231·1	235·0	Ellaton	D	17·0	34·0	40·0
P. Steyn	S	62·7	303·6	305·0	Stilfontein	D	92·0	185·0	180·0
Vaal Reefs	D	143·2	288·4	279·9	W. Rand Cons. (*a*)	D	212·2	423·5	397·1
Welkom	S	59·9	288·9	288·0	**Anglo Transvaal**				
West Reefs Ex.	D	165·9	325·2	316·5	Hartebeestfontein	J	265·0	2101·6	2058·6
Central Mining					Loraine	S	36·0	181·0	171·0
Blyvoor	J	155·0	1235·4	1224·4	N. Klerksdorp	D	11·0	21·5	20·5
Harmony	J	212·8	1589·8	1167·5	Virginia O.F.S.	J	176·9	1416·0	1476·9

Table includes profit from uranium, acid and pyrite before loan redemption. (*a*) Total profit from uranium section. (*b*) Overall profit. * Net revenue after provision for loan redemption.

GHANA MAIN REEF

MR. C. J. BURNS' STATEMENT

The Twenty-sixth Annual General Meeting of Ghana Main Reef, Ltd., was held on March 7, at The Chartered Insurance Institute, London, E.C., **Mr. C. J. Burns**, Chairman, presiding.

The following is an extract from his circulated statement for the year ended June 30, 1959 :—

The confidence expressed in my last review has been justified by the year's results. No further dividend for the year under review can be recommended, since an interim dividend of 7½ per cent and a bonus of 2½ per cent have already been distributed. For the current year your Board have declared an interim dividend of 7½ per cent, less income tax, payable on March 11, 1960.

Two main factors highlight the operations for the year. The installation of a single-drum hoist capable of hoisting waste rock through the sinking compartment in Tuappim Internal Shaft from No. 20 Level to No. 8 Level, was nearly completed, and should be in operation very shortly. The persistent pattern of the main ore shoots has convinced your Board that an exploration programme to depth to prospect the fissured areas between and beyond the known ore shoots is absolutely necessary. Already promising values are being found, giving great encouragement for the future of this phase of development. We have every hope that the mine grade will be increased once the developments at depth have reached a stage which will allow the hoisting of the richer grade ore from the deep levels of the Tuappim section.

Chairman's Additional Remarks

In the course of his speech to stockholders, the chairman said that in the Tuappim section the summary of the payable development exposed to date during the current financial year amounted to 520 ft. averaging 9.4 dwt. over 57.3 in. on Nos. 17, 18 and 19 Levels. This is most encouraging and would prove not only a satisfactory addition to ore reserves but a sound indication that the reef was persisting to depth. Before the end of the year it was confidently expected to expose part of the 20 Level. In the Main Shaft section the summary of payable development for the same period amounts to 165 ft. averaging 11.1 dwt. over 43.9 in. on Nos. 13, 18 and 21 Levels. The No. 18 Level drive north and No. 19 drive north and south would be fully exposed before the end of the financial year.

The chairman reiterated his confidence in the future of Ghana and dwelt upon the need for immediate development of opportunities for suitably trained Ghanaians to enter the mining industry.

Mr. C. W. Tachie-Menson, C.B.E., an eminent Ghanaian, had accepted a seat on the Board and it was hoped he would join them in a few months.

The report was adopted.

The National Coal Board has announced the appointment of Mr. J. S. Williams as a deputy director-general of marketing department. The post is a new one and Mr. Williams will have special responsibility for sales promotion and development. Mr. Williams is at present director and chief executive officer of the Coal Utilisation Council.

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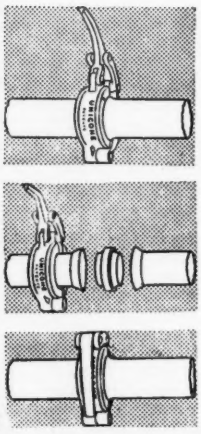

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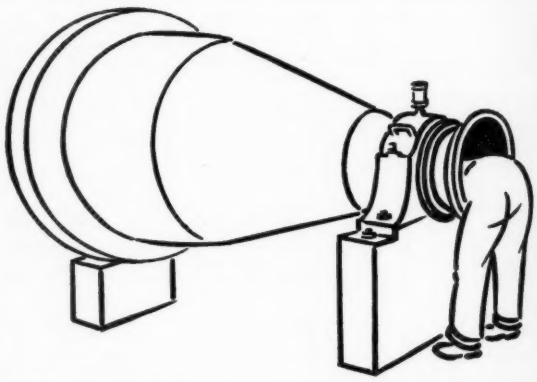

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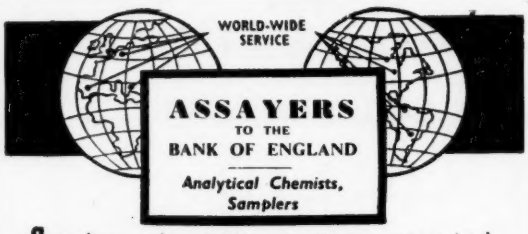

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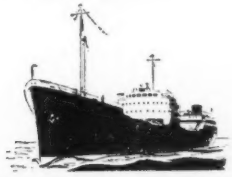

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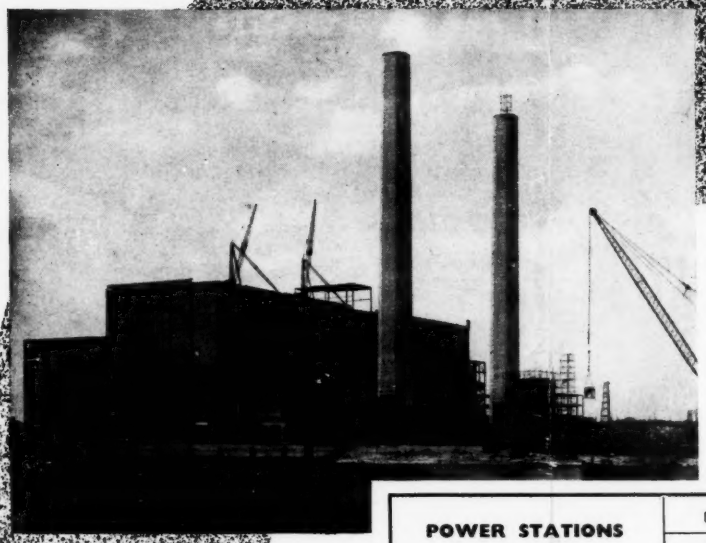

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Carrington B	0.21	0.21
Clarence Dock	0.20	0.099
Cliff Quay (E.C.R.)	0.13	0.056
Croydon B	0.17	0.164
Dunston B	0.35	0.16
Hams Hall B	0.23	0.14
Kingston upon Thames	0.06	0.04
Kirkstall	0.20	0.05
Leicester	0.30	0.21
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